NEW ZEALAND JOURNAL OF Agriculture

JUNE - 1953

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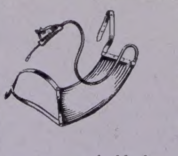

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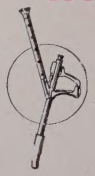

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NEW ZEALAND JOURNAL OF Agriculture

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Direction
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Hon. K. J. Holyoake,
Minister of Agriculture.

This Month's Cover

Phormium tenax, commonly known as flax, was one of New Zealand's first exports. This month's cover shows flax being harvested on the Department of Agriculture's phormium development area at Moutoa, a block of about 4000 acres on the north bank of the Manawatu River about 5 miles from its mouth. At Moutoa there are large areas of swamp and cultivated phormium and further areas are being developed at the rate of about 300 acres a year. Large numbers of wethers, particularly, and cattle are used in developing land which is to be planted in flax.

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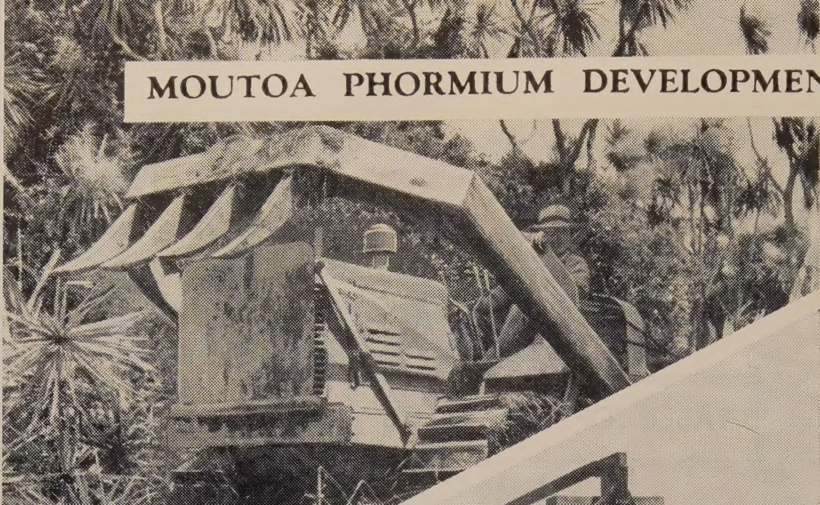
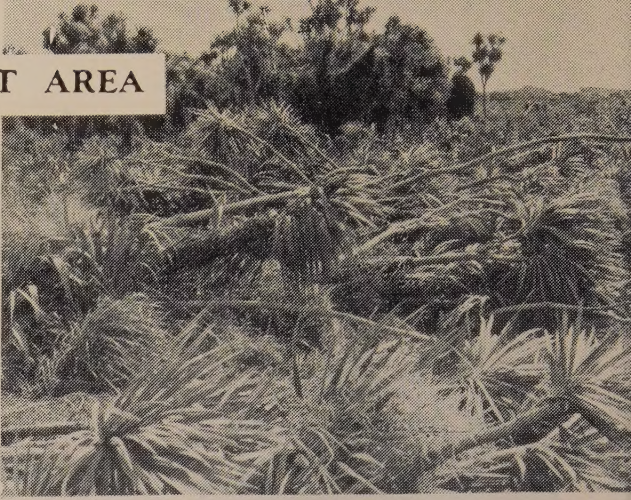
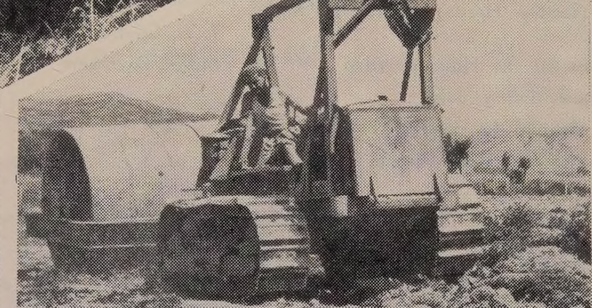
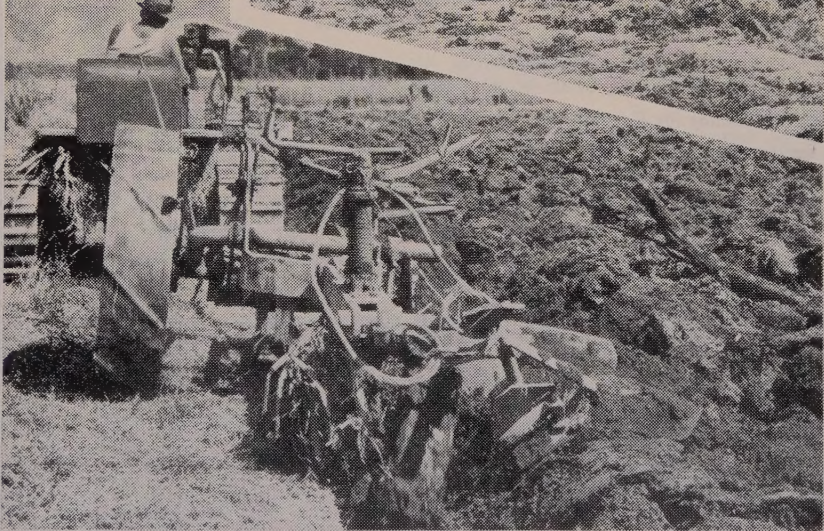
MOUTOA PHORMIUM DEVELOPMENT AREA





The system adopted by the Department of Agriculture in the establishment of new phormium plantations on the Moutoa phormium development area, between Shannon and Foxton, is to clear the heavy growth from the undeveloped land, grass down with Italian ryegrass and white clover, graze hard with wethers for 2 years, and then plant. By this method weeds which would smother the developing plants, chiefly tall fescue, are checked and the cover on the land on which phormium is planted becomes dominantly white clover. As the new stands are establishing the clover sward is grazed with sheep, but numbers are never raised to a level where there would be a risk of the stock chewing the phormium. Upper left—Specially designed fork equipment fitted to the A frame of a heavy tracklaying tractor and used for clearing heavy growth. Upper right—Part of an area being cleared. The trees and scrub are windrowed and burnt when dry. Middle left—Ploughing with a giant swamp plough which turns a furrow of 2ft. 6in. to 2ft. 9in. wide and 12in. to 14in. deep. Middle right—Rolling down the huge furrows with a heavy roller made from traction engine wheels. This rolling is the first operation after ploughing and before working down. Lower left—Planting phormium on the grassed land. Lower right—Harvesting phormium. The crop shown here would yield 35 to 40 tons of green leaf per acre.





HEADING PHOTOGRAPH: Cows will eat poor-quality silage when they will refuse poor hay. The better the silage is the better the results will be.

Feeding Town Supply Herds for Winter Milk Production

By T. A. COULTER, Principal District Inspector, Department of Agriculture,
Palmerston North

A MAJOR cause of small profits realised by many dairymen is the waste of feed on poor types of cows incapable of economic production, but poor feeding of good cows is almost equally serious. No cow can be expected to produce the large flow of milk that she must produce to be profitable unless she receives a sufficient quantity of feed of the right quality. To feed dairy cows profitably a knowledge of what the cow requires and of what kind of feed will best meet these requirements is essential. There are no short cuts to this knowledge. It is secured only by spending time and energy in the study of the subject.

HIGH-QUALITY pastures giving a longer period of grazing during the year are now extensively used, more hay and silage are being made each season, the electric fence has assisted materially in allowing better utilisation of pasture, irrigation has ensured succulent feed in dry weather, and mechanisation of cropping and harvesting has reduced labour considerably. Many town dairymen deserve great credit for the efficient management of their dairy herds, but others evidently give little or no thought to the planning of their requirements. It is not unusual, even in favourable seasons, to find town milk producers entering the winter with nothing more than a limited quantity of inferior hay and unlimited hope for a spell of mild weather.

Foundations of Success

The first and most important requirement leading to success in dairying is that the farmer and all his assistants should be interested in the business. Thoughtful treatment of the herd is essential.

Next in importance is the need to develop a herd of cows capable of producing good-quality milk in the quantities required. A supplier of town milk should try to produce an even quantity of milk throughout the year; toward this end he should arrange for approximately three-quarters of his herd to come into profit in autumn.

Dry cows should be well fed to fit them for the task of producing to capacity during the following lactation.

Too many cows are merely "boarders" and cost the farmer money to keep, yet by intelligent management production of at least 800 gallons per cow a year is within reasonable range. Why keep three cows to produce 1600 gallons of milk when two better cows will do it with the same amount of feed?

On the other hand many a good cow has been culled because through being poorly and wrongly fed she has failed to produce well; if she had been handled by a successful feeder, she would have produced a handsome profit.

Every dairy farmer should belong to a herd-testing association, as the scales and the tester take the guessing out of dairying and are the only sure guide to the cows that pay their way.

Milking and feeding of the herd should be just as promptly and regularly carried out as the farmer's own meal arrangements.

Rear Replacements

The fallacy that on town supply dairies it does not pay and is impracticable to rear replacements should be exploded. There are town milk producers all over the country—many on small areas of high-priced land—who have proved this theory wrong and who, by farming on strictly business lines, are taking greater profits from their cows than were previously deemed possible.

Feeding of calves on a town dairy farm has been made easier by the use of dairy by-products. Calves bred well and fed well will develop into better cows than can normally be bought.

Today the feeding of calves on a town dairy farm has been made easier by the use of dairy by-products. For example, after 2 weeks on whole-milk calves may be gradually changed to powdered buttermilk mixed to the consistency of fairly thick gruel with the fore milk, which should be discarded in any case during milking, and/or water, so that finally the calf receives twice daily not more than 1lb. of the powder per feed. Excellent calves have been reared by this means, even in autumn.

A town milk producer who wishes to be in the forefront cannot get there by purchasing his replacements. Calves bred well and fed well will develop into better cows than can normally be bought. No man sells his best stock as surplus.

Many farmers saving their own calves send them out to graze. Among various arrangements that are made is one that, in return for the grazing, half the calves are given to the other farmer on the understanding that when they are springing, if the grazier does not want them himself, the breeder has first right to buy them at market value. This arrangement pays both parties well.

Town Supply Breed?

For a long time farmers have been looking for a breed of cattle suitable for town supply requirements. It has even been suggested in some quarters that the Government establish centres for breeding suitable stock for sale to dairymen, but this is best left to the farmers themselves. Minimum standards for fat and solids other than fat are laid down by law, and herds of cows with reasonable prospects of complying with these standards at all periods of the year and still capable of high milk production are being established.

The first consideration should be the selection of a breed of cow suitable to the locality. Where difficulty is experienced in producing milk of the required standard of fat and solids other than fat low-testing breeds may be crossed with high-testing breeds. The hybrid vigour thus obtained in the first cross results in a highly productive, disease-resistant animal.

Feed is Half the Breed

An impressive pedigree is useless without feed. On far too many farms all over the country cows are fed a one-sided, unbalanced ration and pasture means a poor, run-out grass paddock which is scarcely more than an exercise ground with little or nothing to graze.

Strong, healthy, vigorous animals are essential in maintaining and developing high production and are the product of proper feeding from calfhood.

It is justly claimed that with such animals calving troubles and other problems common to the average dairy herd are much less evident.

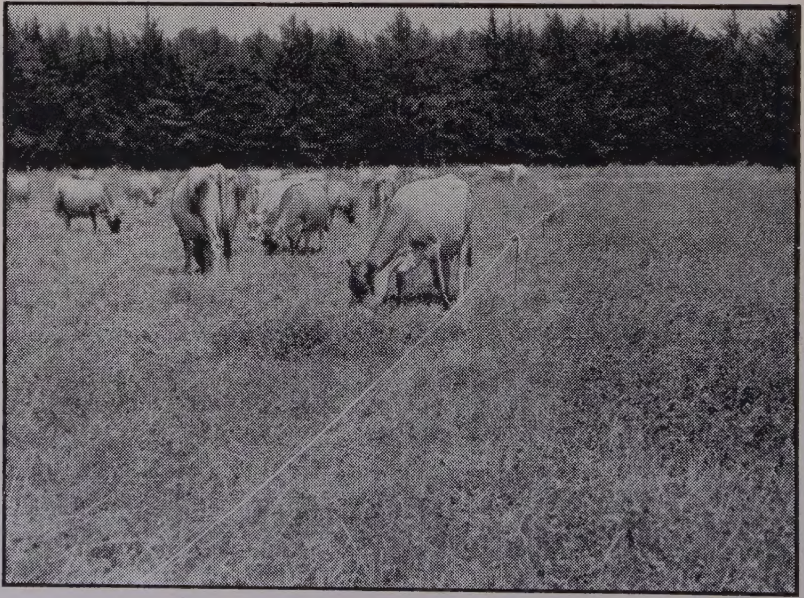
Pasture Management

Paddocks should be small and high-quality Certified grasses and clovers should be sown. Pastures should not be allowed to become run out. Young pastures produce more growth of a higher feed value than old ones, though with careful management and topdressing excellent pastures may last for many years.

In those localities where it is possible to save autumn pasture advantage should be taken to utilise this supply of winter feed to the full. Careful management is necessary, however; the pasture should not be allowed to grow higher than 8 or 9in. and if it is not needed at this stage, the mower, followed by a light grazing, will reduce it to the required height. This allows sunlight to penetrate it and prevents the bases of the leaves yellowing.

The electric fence should be used to allow sufficient for a day's grazing for the herd, the area allotted being increased or decreased as circumstances dictate. As a rough guide 1 acre is sufficient for 80 cows per day.

The cows are returned to this same paddock for the night, but if the paddock is too far from the milking shed,



The electric fence has assisted materially in town milk production by enabling better use of pastures. With it feed in a paddock can be rationed in amounts of a day's grazing for the herd.

a night paddock may be used, although only when absolutely necessary.

[*National Publicity*

Cutting and feeding of chou moellier in wet weather are unpleasant compared with the feeding of silage.

Feeding of Silage

Supplementary feeding with silage or chou moellier and hay should be carried out on the paddock or break which was grazed the previous day to ensure that fertility is maintained in every paddock grazed.

Where no hay is used a load of silage should be fed before breakfast. Feed is not generally weighed in New Zealand; the farmer soon knows from observation the size of the load necessary to satisfy the herd. Silage is a production ration, whereas hay is a maintenance ration.

After breakfast a second load should be cut and fed out. When any frost has disappeared the cows should go on to the saved pasture break for the day. Another load of silage should then be cut and loaded ready for the next morning. Having a strong odour, silage is one of the feeds which should be fed out well before milking time.

In the feeding of saved pasture care must be taken not to graze too closely. Close grazing causes a very slow recovery of pasture. Allowing cows to back graze over fed-off paddocks also retards recovery of pasture and should be avoided.

As each paddock is fed off and silage feeding is completed the mower is used immediately. The effect of the mower is twofold; it cuts any grass not eaten and spreads the manure as effectively as harrowing. Maximum fresh growth is obtained by closing up each grazed paddock as soon as possible. The more of this feed that is saved the less hay will be required.

Good silage should be fed to capacity and by saving some pasture until spring scouring should not be experienced even when no hay at all is used.

Much inferior silage is made. Cows will eat poor-quality silage when they will refuse poor hay. The better the silage is the better the results will be, and the advice of instructors of the Department should be sought on pastures and silage improvement.

Home-grown Foods

Where autumn-saved pasture is not abundant attention should be directed toward growing more supplementary feeds.

The supplementary feed provided will depend on the area and the locality of the farm. Hay and chou moellier, with possibly greenfeed for late autumn and early winter, are quite suitable for a small farm, but where possible silage should be made. For this purpose, if suitable land is available, a good lucerne stand is ideal.

Every farmer should grow on his farm as much as possible of the feed which will furnish a balanced ration for his cows. This may increase the farm labour costs, but will pay handsomely in the end.

The theory of feeding balanced rations is much misunderstood. Many farmers dismiss it as something impracticable or technical which they cannot understand, but a balanced ration is simply one in which the nutrients are in the right quantity and proportion to secure the largest quantity of the best milk at the least cost.

Cows prefer variety in their food and this variety stimulates the appetite and helps to increase milk yield. The cows should be kept full of good feed and busy converting it into ever-increasing milk production.

Chou Moellier

With large herds the cutting and feeding of chou moellier in wet weather are unpleasant compared with the feeding of silage.

Chou moellier is sometimes grazed in breaks, but this has disadvantages in wet weather too. For instance, it tends to cause cows to become very dirty, and in winter producing clean milk is hard enough without this added difficulty.

When chou moellier is being break fed cows should be given a ration of hay after the morning milking and not put on to the chou moellier until all signs of frost have disappeared, usually about 10 a.m. They should be removed again **not later than 1 p.m.** Discretion should be exercised, however, and,

Hay is usually fit only for a maintenance ration and not for milk production, but in most districts a certain amount of hay should be fed to promote warmth.

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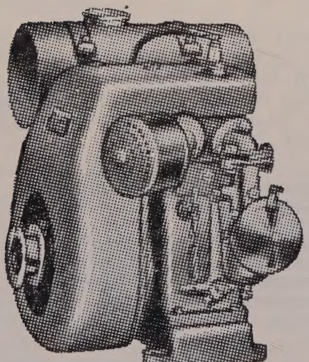

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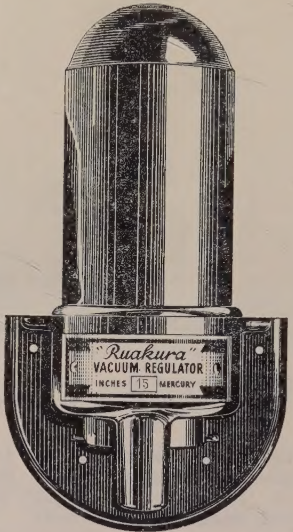

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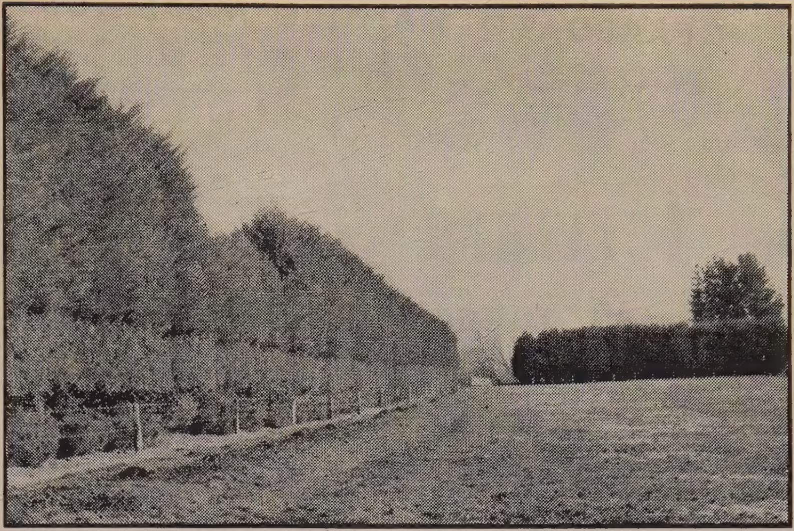

On well-drained, warm land provision of efficient shelter belts with the bottoms protected from stock so that damage to the lower branches does not promote ground draughts will usually safeguard winter milking if the cows are covered.

depending on the feed available, a shorter time may be advisable.

Overfeeding with chou moellier must be avoided and prior access to hay is essential. Heavy losses at calving time from redwater will follow neglect to observe this precaution. For the average cow ½cwt. per day is ample. Chou moellier and silage should never be fed at the one meal, as a combination of these two feeds may result in blown cows and other digestive disorders.

Owing to wet weather making paddocks too soft difficulty sometimes arises in feeding off greenfeed such as oats and Italian ryegrass. Consequently chou moellier is the most reliable form of greenfeed, although it may involve more work.

Another greenfeed worthy of a trial is the comparatively recent introduction fodder beet with a feed value equal to that of mangolds and a utilisation period from May to August.

The feed value of chou moellier is spent by late August and in districts where spring growth has not begun mangolds are very useful to be fed with good hay at this critical period. Mangolds should never be fed while frost is on them.

Hay

Surprisingly little really first-class hay is made, often because of the vagaries of the weather, the average hay being fit only for a maintenance ration and not at all suitable for milk production in winter. However, in most districts a certain amount is required for warmth, but large quantities of low-quality fibrous food have the effect of reducing rather than increasing the milk yield. The best available hay should be reserved for the spring to offset the laxative effect of young grass. At this time of year it is difficult sometimes to coax cows to eat good, much less inferior, hay.

A plentiful supply of highly nutritious foods should be used and only sufficient hay for a maintenance ration given. This ranges between approximately 15lb. for a small cow and 20lb. for a large cow per day. Too many town supply dairymen are still predisposed toward hay. Others have proved that large quantities of milk-producing silage may be fed without any hay. Where autumn-saved pasture is not relied on cows will remain in better health and give a higher yield if more silage is fed.

Recommendations are:—

After the morning milking a ration of hay should be fed.

Later, about 11 a.m., as much silage or chou moellier as the cows will consume should be given.

After milking in the evening the balance of the hay ration and a full feed of silage should be provided.

Concentrates

Concentrates are generally in short supply and are costly. Bran, crushed grain, brewers' grains, and dairy meals are often used in varying quantities. On farms where there is not an abundance of autumn-saved pasture they give that extra nourishment to well-bred, well-fed cows to enable them to produce to capacity during winter. The addition of 4lb. of bran supplemented with any one of the following to the daily ration is worth consideration:—

1. Crushed barley, 2lb., and crushed peas, 2lb., or
2. Crushed oats, 4lb., or
3. Wet brewers' grains, 9lb.

Wet brewers' grains should be fed with discretion. They are frequently fed in large quantities, up to 20 or 30lb. a day, to stimulate milk yield. As they do not stimulate butterfat production, this excessive feeding leads to the production of large quantities of poor-quality milk.

Wet grains fed liberally, by overstimulating milk production, are reputed to lower the vitality or constitution of the cow.

Warmth and Shelter

Feed is a necessary complement to breed, but for winter production of milk warmth is just as important as either of these. The warmer a cow is kept the less feed it will need to use to maintain body heat and thus more of the feed it eats can be converted into milk.

On well-drained, warm land provision of efficient shelter belts will be sufficient to safeguard winter milking if the cows are covered. In cold regions the stalling of dairy cows in winter pays handsome dividends, and in many wet localities provision of a shed especially for feeding in has much to commend it. Where cattle are fed in this way paddocks are not pugged, pastures get a better start in the spring, less feed is wasted and daily milk production is maintained at a steady level irrespective of weather.

A clean and ample water supply should be available not only in feeding sheds but in all paddocks. A cow in full milk may drink about 30 gallons of water a day. Salt, too, is necessary for cattle, and all dairy cows should have ready access to it.

A cow in full milk may drink 30 gallons of water a day and a clean and ample supply should be available in all paddocks and feeding sheds.

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Dwarf Fruit Trees for the Home Garden

THE introduction of dwarfing rootstocks for apples and pears enables the home gardener to grow a greater variety of fruit in a limited area. The trees crop earlier and are more easily handled than the standard type of tree. In this article M. G. Baumgart, Horticultural Instructor, Department of Agriculture, Christchurch, discusses their advantages and the methods of cultivation.

THE idea of growing dwarf trees has only recently appealed to many home gardeners. Although dwarfing rootstocks from East Malling have been under trial by the Fruit Research Station of the Department of Scientific and Industrial Research for some 20 years, it is only since the Second World War that commercial nurseries have imported and propagated East Malling dwarfing stocks. Trees worked on these stocks are now sold by many nurseries. At present suitable dwarfing rootstocks are available only for apples and pears, though some semi-dwarfing rootstocks for stone fruits have been propagated in the North Island. It is hoped that within the next few years suitable dwarfing rootstocks will be readily available for stone fruits, as selection and experiment along these lines are being carried on by the Fruit Research Station.

Dwarf fruit trees grown in the home garden offer many advantages. A greater number of varieties may be grown in a restricted area, cultural operations are easier, and the trees crop earlier than the usual standard types. Gardens or lawns may be grown satisfactorily much closer to the dwarf trees.

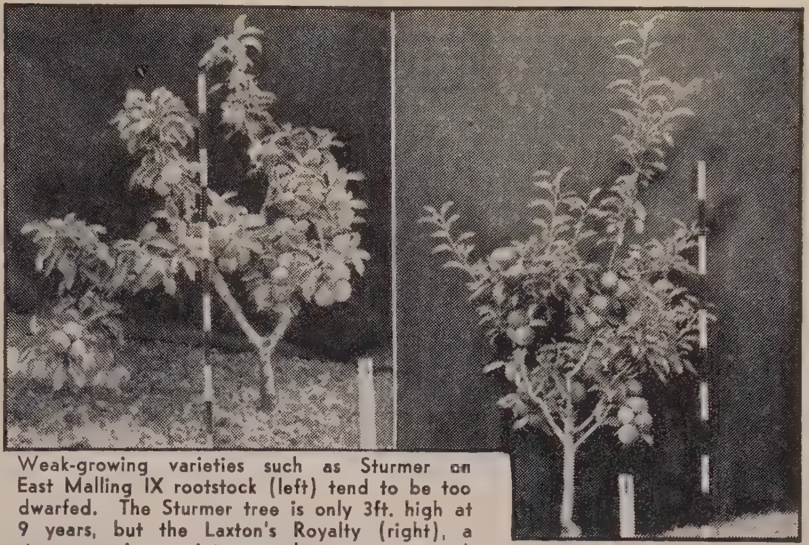
Rootstocks

Fruit trees do not usually consist of the same variety throughout, the roots and the parts above ground being normally of two different varieties. A variety is selected for producing a good root system and the required fruiting variety is budded or grafted on this rootstock 4in. to 6in. above ground level. When the tree is being planted it is important that this bud union be kept well above ground level or the top variety may produce roots and the advantages of the rootstock will be lost.

For dwarfing purposes the most widely used rootstock for apples is East Malling IX, whose effect is very dwarfing. The more vigorous varieties such as Gravenstein, Cox's Orange Pippin, Delicious, and Golden Delicious will make trees 4 to 6ft. high, but the effect on weak-growing varieties such as Sturmer and Tasma tends to be too dwarfing, especially in southern districts. These varieties are usually small enough when on Northern Spy stock, especially if they are allowed to crop fairly early in life.

Though East Malling IX is the only true dwarfing stock in the Paradise group of apple rootstocks, certain other types in this group have a semi-dwarfing effect and may be used where East Malling IX is insufficiently vigorous. These types include the East Malling stocks I, II, and VII.

For pears East Malling quinces A and C are the most suitable dwarfing stocks at present. Quince C is more dwarfing than A. Many varieties of pears do not make good unions when worked directly on quince, so double working is practised; that is, a variety which is compatible with quince is budded or grafted on the stock, then the required variety is worked on to the intermediate. Beurre Hardy and Louise Bonne de Jersey have proved good intermediates.



Weak-growing varieties such as Sturmer on East Malling IX rootstock (left) tend to be too dwarfed. The Sturmer tree is only 3ft. high at 9 years, but the Laxton's Royalty (right), a strong-growing variety, on the same rootstock has grown to 3ft. in 3 years.

Until more is known regarding the compatibility of pear with quince it is considered wise to double work all trees.

Site of Trees

All fruit trees should have adequate sunshine and shelter from strong winds. Dwarf trees do not cast as much shadow as standard trees, and may be grown in any part of the section, as lawns, flowers, or vegetables grow well close to them.

Planting Distances

Trees on East Malling IX should be planted 8ft. apart and at least 4ft. from the boundary. Pears on quince stock should be planted at least 10ft. apart and 6ft. from the boundary. They may also be grown as cordons, trained as a single rod at an angle of 45 degrees, or as espaliers; then the planting distances would be entirely different. An article on espaliers appeared in the "Journal" of July 1951.

Maintenance Work

Manuring

Dwarf trees require considerable feeding once they are established, as they tend to stop growing completely and become unthrifty. Organic manures dug in round the trees supplemented with light dressings of potash are adequate. Where artificial manures are used a mixture of 1 part of sulphate of ammonia, 2 parts of superphosphate, 2 parts of blood and bone, and 1 part of sulphate of potash, all by weight, should be applied at 2 to 4lb. per tree, depending on the growth and age of the tree.

Pruning

For home gardeners the dwarf bush type of tree is most satisfactory and most easily trained and cared for. Pruning at planting time is similar to that of standard trees, the object being by hard cutting to form a branched, open-centred tree. A replacement system of pruning is generally adopted for stronger-growing varieties. Spur pruning is recommended for varieties such as Sturmer which produce spurs freely.

Staking

All varieties of apples grown on East Malling IX require staking, as the roots are particularly brittle and the branches are not strong enough to support a crop of fruit. The stake should be of durable material, 1in. piping or 2in. x 2in. hardwood being most satisfactory, and should be approximately 7ft. long and driven 3ft. into the ground close to the trunk. The leaders of the tree can then be supported by running wires or light rope from the stake to the limbs.

Cropping

Apples on East Malling IX normally carry up to 1 bushel per tree and begin to crop the second year from planting. As trees 15 years old are still growing satisfactorily, it appears that they have a normal life. Pears on quince stocks normally carry crops of from 1 to 3 bushels per tree and will begin cropping about the fourth year from planting.

Spraying

As the trees are small, spraying is considerably easier than with normal-type trees. Spray programmes vary for different districts. Local recommendations may be obtained from the Horticultural Instructor at the nearest office of the Department of Agriculture.

Photographs by Department of Scientific and Industrial Research.

Care of Livestock during July

Contributed by the Animal Research Division

PULPY KIDNEY IN LAMBS

WHERE pulpy kidney occurs in lambs under 6 weeks of age its incidence can be reduced by vaccinating the ewes before lambing. If ewes have never been vaccinated before, best results will be obtained from 2 doses of vaccine given at least 1 month apart. Ewes which were vaccinated last year will require only 1 vaccination. The last (or the only) vaccination should be given about a fortnight before lambing and this can be done quite safely if ewes are handled carefully. Very poor immunity results where the ewes are vaccinated much earlier. If most losses from pulpy kidney occur in lambs over 6 weeks of age, vaccination of ewes is of no value, but vaccination of lambs at marking may help.

BLOOD POISONING IN EWES AND LAMBS

Losses from blood poisoning in lambing ewes and marked lambs appear to be increasing in some districts. They may be greatly reduced, if not eliminated, by vaccinating the ewes with blackleg vaccine about a fortnight before lambing. As the immunity which passes from the ewe to the lamb in the first milk does not persist for many weeks, lambs should be marked early. To obtain the best results it may be necessary to divide the ewes into early and late lambers, which should be vaccinated separately to ensure that all ewes are vaccinated from 10 to 20 days before lambing. Advice concerning vaccination can be obtained from any office of the Department of Agriculture. Where possible ewes should lamb in clean spelled paddocks, and lambs should always be marked in clean temporary yards. Sometimes losses from blood poisoning occur in lambing ewes that have not been vaccinated. If losses are occurring, it is too late to vaccinate. It may be possible to save some ewes by treating them with penicillin if the penicillin is used early enough. It is important that blood poisoning be confirmed, and the local veterinarian should be consulted in this matter. After such confirmation all ewes which are assisted in lambing should be treated by penicillin injection. This should be an emergency measure and should not replace vaccination, which is the cheapest and most certain means of treating blood poisoning.

SLEEPY SICKNESS IN EWES

Heavy losses from sleepy sickness sometimes occur in ewes carrying twins or heavy single lambs. These losses may be prevented by ensuring that ewes do not suffer a check just before lambing. If necessary, they should be divided into early and late lambers and drafted on to the best feed available 3 to 4 weeks before lambing. Recent work has indicated that glycerine properly used as a drench may save some cases of sleepy sickness. The local veterinarian should be consulted on this matter. Research has shown that poor feed for 5 weeks before lambing can reduce the fleece weight by more than ½lb.

RINGWORM IN CALVES

Ringworm in calves is sometimes troublesome, especially in poorly nourished calves. Before any remedy is applied the scales should be removed by rubbing in a mixture of equal parts of soft soap and lard and scraping off the softened scabs the next day. The bare patches should then be dressed with an ointment consisting of 1 part of salicylic acid and 8 parts of lard or any registered stock remedy for ringworm which is available. As the infection can be transmitted to man, it is wise to wear rubber gloves when treating ringworm. In any case the hands and arms should be thoroughly washed immediately after the dressings are applied.

ERGOTISM IN CATTLE

Hay made from ergotised grass will cause lameness and sometimes even loss of feet in cattle. The small black ergots which replace the seeds of ryegrass and other grasses can easily be seen, and if they are present in large numbers, the hay should not be used. Similar trouble often occurs when cattle are grazed on tall fescue grass even when no ergots are present. This grass should be regarded as poisonous and should not be grazed by cattle.

WINTER FEEDING OF COWS

It is imperative that cows should be well fed for 6 to 8 weeks before calving. They should have access to hay at all times, and if the pasture is poor, they should also receive up to 20lb. of silage per day. Early-calving cows should be given about 2 hours' grazing per day on autumn-saved pasture and in addition should be fed as much silage as they will eat.

MILKING METHODS ARE IMPORTANT

At the start of a new season cows should be trained to let down their milk quickly and completely by the establishment of a fixed milking routine so that the cows are brought into the shed, bailed up, washed, and milked in the same way at each milking. Anything which upsets the cows must be avoided. A brief but vigorous wash followed by the withdrawal of a squirt of milk from each quarter is the best method of stimulating the flow of milk. As the duration of let-down is limited, the cups should be put on immediately after washing and the removal of the first milk. Strippings arise from two causes. First, cows which are not properly stimulated to let down their milk at the start of milking often give another let-down when stripped. Secondly, cups tend to crawl up the teats toward the end of milking and cut off the flow of milk. This can be overcome by pulling down on the cups a few seconds before their removal. Hand stripping is unnecessary. A good milk flow indicator is essential for the correct application of these principles.

Dairy Produce Graded for Export

THE following figures showing quantities of dairy produce graded for export during April and for the 9 months ended 30 April 1953, with comparative figures for the same month and 9-monthly period of 1951-52, have been compiled by the Dairy Division of the Department of Agriculture from figures supplied by divisional officers at the various grading ports:—

BUTTER

		Tons		Percentage
Period	Creamery	Whey	Total	inc. or dec.
April 1953	8,266	229	8,495	—
April 1952	8,656	194	8,850	—
Increase or decrease ..	—390	+35	—355	—4.011
9 months ended 30/4/53	155,322	2,963	158,285	—
9 months ended 30/4/52	151,220	2,529	153,749	—
Increase or decrease ..	+4,102	+434	+4,536	+2.950

Butter in store at 30 April 1953 was 20,286 tons

CHEESE

		Tons		Percentage
Period	White	Coloured	Total	inc. or dec.
April 1953	7,847	6	7,853	—
April 1952	6,425	178	6,603	—
Increase or decrease ..	+1,422	—172	+1,250	+18.930
9 months ended 30/4/53	95,946	140	96,086	—
9 months ended 30/4/52	85,498	748	86,246	—
Increase or decrease ..	+10,448	—608	+9,840	+11.409

Cheese in store at 30 April 1953 was 20,629 tons

If these figures are converted into butterfat equivalent, there is an increase of 4.657 per cent. in butterfat graded for the 9 months as compared with the corresponding period of the preceding season. The above figures refer only to butter and cheese graded for export, and owing to diversions which may take place from time to time, they are not necessarily a true indication of production trends

Rotational Grazing on Dairy Farms

Seasonal Notes by the Extension Division

NEARLY every dairy farmer in New Zealand can claim that he practises rotational grazing of pastures because his milking herd is kept in a mob for convenience in bringing the cows into the milking shed twice a day and the herd is moved round the farm from paddock to paddock in a mob to graze the feed available in the paddocks. There is, however, far more to efficient rotational grazing than the haphazard grazing of paddocks in turn according to the feed in them. This difference can best be illustrated by comparing the grazing management on a farm where pasture management and utilisation are really efficient and are reflected in high butterfat production per acre and on one where, despite a so-called system of rotational grazing, management and utilisation are inefficient and production of butterfat suffers accordingly.

EFFICIENT ROTATIONAL GRAZING

UNDER an efficient rotational grazing system the aim is to spell each paddock in turn for as long as possible to allow the grass a chance to grow for the next grazing. In autumn, when the cows are drying off, as much of the farm as possible, usually from a quarter to a third of the available area, is closed to save the autumn and winter feed for the milking cows when they calve in spring. This feed is too good for dry cows. In early spring this saved feed is rationed and supplemented with hay and silage so that a full ration is provided for several weeks.

Meanwhile the remainder of the farm has been rotationally grazed by the dry stock, which are also given supplementary feed. These paddocks are spelled in turn for periods of 5 to 6 weeks in winter and early spring to make growth which is ready for feeding off to the milkers after the winter-saved grass. During spring the feed available is strictly rationed and is supplemented with silage and hay. Each paddock is thus made to last the herd several days so that the remaining paddocks can be closed for the relatively long period necessary at this time of year for them to produce the type of feed required by milking cows.

In late spring and early summer, when feed is abundant, the herd is concentrated on as little as half the farm, the surplus growth on the remainder of the farm being harvested as silage in November and early December and for hay in late December. The portable electric fence is a great help in spring and early summer, because its use makes each paddock last longer. For summer and early autumn the herd has the whole farm available, part kept in good grazing condition by the concentration of the herd during the flush and part by the removal of surplus growth quite early in the summer. Topping with the mower is also used to keep the feed suitable for milk production.

INEFFICIENT ROTATIONAL GRAZING

Where inefficient rotational grazing is practised the rotation is not planned to give each paddock as long a spell as possible in times of slow growth nor to concentrate the grazing at times of flush growth in order to conserve this feed for use when it is most required. It cannot be denied that a rotation of sorts is practised, because the cows are shifted from paddock to paddock round the farm, but the grazing management is detrimental to the pastures and fails by a long way to obtain maximum production. The common practice is to use all the autumn flush for the cows as they dry off to save the work of feeding out supplementary feed. The farm is bare in winter and the grass cannot grow, as it has no leafage.

As the spring growth starts the fresh milkers are moved round the farm often with a daily shift to a new paddock. After the second or third round some feed is left, but because the cows do not like it, the quick rotation is continued. There soon comes a time, usually in November or early December, when up to half of each paddock is carrying roughage and the herd in effect has only half the farm acreage for grazing. It is not possible to save this scattered surplus growth, and the best that can be done is to shut up one or two paddocks with the most roughage for a poor hay crop. As soon as dry weather comes the roughage dries off and the cows are left with a very much reduced acreage of still green pasture. Butterfat production per acre can never be high when so much feed is wasted, and a large proportion of the farm goes out of production through roughage for a good part of the year.

—*C. J. HAMBLYN*

* * *

TRACTOR OVERHAUL

THE farm tractor represents a substantial capital investment and is the source of most power on the farm. As such, it deserves regular attention and overhaul, for it must be ready to supply economical power whenever required. Winter offers an opportunity to give this machine a thorough overhaul to ensure that it will be in top-notch condition for the coming season's work. When a tractor is delivered it carries an instruction book or operator's manual that covers the operation, lubrication, adjustment, and service data for the particular model. This booklet will contain all the instructions necessary for a winter overhaul.

Naturally, some phases of the overhaul of a machine that has done several years' work will require the services of a qualified mechanic, but the charge for his services can be regarded as a worthwhile investment that will ensure that next season's crops are sown and harvested with minimum delay. The tractor's worst enemies are dirt, dust, and careless operators. Most tractors are equipped with efficient filtering systems in the air and oil lines, which, if regularly serviced, will take care of the dirt and dust, but carelessness is the operator's responsibility. Only by avoiding misuse, by regular service, and periodic overhaul can full value be obtained from a tractor investment.

—*C. J. CROSBIE*

* * *

BUILDING REPAIRS AND MAINTENANCE

THOUGH modern trends favour the use of durable masonry materials, which reduce repair and upkeep work to a minimum, the vast majority of farm buildings are of wooden construction. Although they are very serviceable and adaptable for building, most timbers, especially the softwoods now prevalently employed, are susceptible to weathering and decay unless they receive adequate protection. This involves both initial and periodical maintenance and repair treatments to prevent or discourage attacks by fungoid disease or timber-boring insects. Fungoid disease, which usually appears as a disintegrating "dry rot", normally develops where exposed timbers are subject to weathering and dampness because of penetration and absorption of rain-water.

Insects, mostly of the termite groups, normally operate in the comparative darkness of unexposed timbers beneath the flooring and within the framework and lining. The onset of their attack is usually less conspicuous though none the less insidious. Dry rot infections can be prevented by prompt attention to such obviously needed repair and maintenance details as periodical painting with oil, coal tar derivative, or bitumastic or synthetic resin paints; repair or renewal of leaking or blocked spouting and downpipes; renailing of warped facing boards or loose roofing iron, ridging, and flashings; repairs to ill-fitting and broken windows; and attention to any item that allows water to penetrate into or between building timbers. Adequate sub-floor ventilation is also essential if dampness and decay of wooden piles and flooring timber are to be avoided.

—*A. R. DINGWALL*

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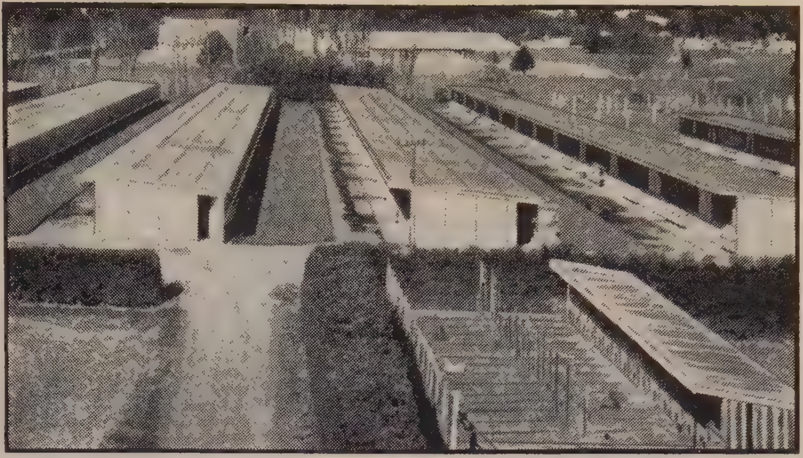
Fourth Trial of Prospective Poultry Breeding Stock

IN the fourth breeders' laying trial held at the Department of Agriculture's Poultry Demonstration Plant, Upper Hutt, which started on 25 February 1952 and ended on 25 January 1953, there were 31 pens or 620 pullets, the largest number of entries since this trial was established in 1949. In this article F. C. Bobby, Superintendent, Poultry Industry, Department of Agriculture, Wellington, and W. R. Belworthy, Technician at the Poultry Demonstration Plant, review the results obtained in the 1952-53 trial.



The two middle intensive laying houses were those used for the trial at the Poultry Demonstration Plant.

THE 31 pens or 620 pullets entered for the 1952-53 trial represented an increase of 100 pullets or 5 pens compared with the 1951-52 trial. There were 19 pens of White Leghorns, 9 of Australorps, 2 of Rhode Island Reds, and 1 of Barred Rocks. The standard of the birds penned at the start of the trial was considered to be higher than for the previous year, but the results subsequently obtained with these birds were not as good as those obtained in 1951-52. This appears to reflect a seasonal trend, as the general egg production for all breeds at the Poultry Demonstration Plant was lower than for the previous year.

Transport difficulties were again experienced, as it became necessary to hold a number of pens at the plant after the end of the trial until railway facilities were restored after the floods around Palmerston North. Subsequent reports indicated that the pens travelling to Auckland and beyond were unduly long in reaching their destinations. No delays are experienced when these birds travel south to Wellington and the Department of Agriculture will ensure as far as possible that they travel north more satisfactorily at the end of the 1953-54 trial.

General Management

As in previous years all pens were housed intensively with each bird having 8 sq. ft. of floor space. An ample depth of straw litter was maintained in all pens throughout the trial. All pens were trap nested for the 48 weeks of the trial and eggs weighed for 2 weeks of the third, sixth, ninth, and twelfth 4-week periods or until 6 eggs had been weighed in each period for each bird in lay. Original trap nest record sheets and post-mortem reports, if any, were forwarded to all owners at the end of each period. Birds were weighed on arrival and again at the end of the trial. The final weights for each bird are shown in the table on page 511.

Pens were fed with wet mash and grain, with the additions of greenfeed, oyster shell grit, metal grit, and water. The programme of feeding consisted of a light grain feed early in the morning, wet mash at 10.30 a.m., and grain feed at 4 p.m. Approximately ½oz. of grain per bird was fed in the early morning and 1½oz. per bird at the afternoon feed. The birds were allowed as much wet mash as they would comfortably clear up in about 30 minutes. Greenfeed was given daily at 1 p.m. On Sundays no wet mash was fed, but a full grain feed was given in the morning and late afternoon.

The grain mixture consisted of wheat, barley, oats, and kibbled maize in approximately the following proportions:—

	lb.
Wheat	1,080
Barley	150
Oats	160
Maize	200
	1,590

The quantity of kibbled maize was varied according to the average condition of the birds and the rate of egg production. In particular it has been customary to increase the proportion of maize during the last 4 to 6 weeks of the trial.

The formula for the mash was similar to that used for the 1951-52 trial:—

	lb.
Bran	22
Pollard	20
Wheat meal	24
Ground oats	7
Maize meal	10
Meat meal	15
Common salt	1
Oyster shell dust	1
	100

Owing to the surplus barley available for poultry feeding, ground oats were replaced by barley half-way through the trial. A feeding oil containing 2000 international units of vitamin A and 200 units of vitamin D per gramme was added to the mash at the rate of ¾ pint of oil to each 100lb. of dry mash. Meat meal was included at the rate of 10 per cent. during the first period and thereafter at 15 per cent.

The primary object of the trial is to afford facilities to poultry breeders to test their pullets, whether a general sample of the flock, a special blood line, or imported blood, to find those most suitable for breeding from when hens. To assist breeders who enter pens in the trial all pullets at the completion of the trial are handled and examined. Birds which satisfy the following requirements are accredited or recommended for breeding next season:—

1. Have given a total of 180 eggs or more.
2. Weighed a minimum of 4¾lb. for light breed birds and 5¾lb. for heavy breed birds at the close of the trial.
3. Have laid a preponderance of 2oz. or heavier eggs during the four periods of egg weighing.
4. Are reasonable specimens of their breed and have no major faults or body deformities.

Although a standard is set, it is realised that owners will breed from some of the unaccredited stock particularly where the number of eggs laid falls short by a few eggs of the standard or where under-weight pullets subsequently attain satisfactory hen weight.

However, the purpose of this report is to give credit to owners who have a satisfactory number of accredited breeders. Consequently the table of results obtained with individual birds (see page 511) is set out in order of merit according to the number of birds accredited in each pen. Owners having the greatest number of potential breeding birds were: A. Aldworth and R. Willers (11 accredited Australorps), J. R. Phare (10 accredited Australorps), and J. Burton (10 accredited White Leghorns). Among the pens of heavy breed pullets J. A. Walker owned the accredited Australorp pullet with the highest egg total, 266. This pen also contained the pullet with the highest egg total for the trial, 280 eggs, but unfortunately this bird could not be accredited owing to the size of eggs laid. The highest total for an accredited White Leghorn, 249 eggs, was recorded by a bird owned by E. Brown.

Names and addresses of breeders who entered pens in the trial under section A only are given on page 511. Under the conditions governing the trial names are not given of those entering birds in section B.

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Mr. Brook concludes: "I should add that our pasture has intensified in density and in quality since the experiment, due no doubt to more excreta from greater numbers of stock and new residuals due to the inbrought fodder".

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Pen No.	Name and address	Pen No.	Name and address
8	Aldworth, A., Main Road, Te Horo	26	Parkinson, C. and E., R.D. 3, Napier
12	Batkin, L., Bromley Park, Tuakau	6 and 22	Phare, J. R., Maroeka R.D., Te Puke
10	Bedford, L. G., 9 Avice Street, Remuera, Auckland	30	Ryde, B. F., Ngamutawa Road, Masterton
23	Bradley, C. L., c/o Howick P.O.	11 and 27	Salisbury's Ltd., Upper Hutt
31	Brown, E., No. 1 Line, Foxton	5	Smith, A. J., Omahu Road, Hastings
16	Burton, J., Pitt Street, Clive	7	Smith, G. L. A., Aerodrome Road, Omaka, Blenheim
28	Chamberlain, D. K., Box 32, Waverley	17	Wade, G. W., R.D. Mauna, Whangarei
14	Hope, M. R., Poukawa	1 and 13	Walker, G. A., Beach Road, Te Horo
2	Iorns, G., Burness Road, Greenmeadows	3	Willers, R., 24 Marlborough Street, Feilding
25	Lim, N. P., Renwicktown, Blenheim		
9	Mitchell, M. S., Lower Te Mata, Havelock North		

Egg Production

Though average egg production was lower for both heavy and light breeds than in the previous year's trial, 2 pens of Australorps owned by G. A. Walker and A. Aldworth respectively passed the 4000 egg total and had an average of over 200 eggs per bird as against 1 pen of White Leghorns in 1952-53. The total egg production for each pen entered is given in the first table on the next page.

BREEDER AND PEN NUMBER	WEIGHT (in pounds) OF EACH BIRD AT END OF TRIAL AND 48 WEEKS' PRODUCTION OF EACH BIRD																				TOTAL FOR PEN (Including floor eggs)
Australorps																					
Aldworth, A. ..	6.7	7.0	5.9	5.7	6.4	5.7	7.0	6.4	6.4	6.0	7.0‖	5.3	5.7	5.5	6.3	4.8	5.9	6.0			
(8)	**195**	**211**	**205**	**221**	**204**	**213**	**189**	**228**	**187**	**247**	**185**‖	156	*203	230	171	225	164	*243			4,027
Willers, R. ..	6.9	6.2	7.0	6.4	7.3	5.7	6.5	6.4	6.2	6.1	6.0‖	6.5	5.4	5.3	5.5	4.7	6.4	6.2	5.6		
(3)	**246**	**219**	**211**	**222**	**216**	**209**	**210**	**211**	**212**	**202**	**219**‖	152	238	127	153	183	128	171	226		3,847
Phare, J. R. ..	5.8	5.7	5.7	6.2	6.0	5.8	6.4	6.3	5.9	6.2‖	5.8	5.4	6.2	6.6	6.3	6.1	6.2	5.4	5.8		
(6)	**197**	**220**	**208**	**183**	**182**	**229**	**204**	**201**	**181**	**204**‖	184	207	172	160	176	150	113	204	137		3,554
Smith, A. J. ..	6.4	6.5	6.4	6.6	6.5	6.1	7.6	5.7	6.6‖	5.5	5.2	7.2	4.8	4.8	6.4	5.5					
(5)	**188**	**241**	**189**	**223**	**248**	**224**	**199**	**219**	**221**‖	238	150	176	52	194	66	224					3,480
Iorns, G. ..	6.5	6.2	6.9	8.0	6.5	6.0	5.8	7.6‖	6.6	6.6	6.4	5.3	5.1	5.3	5.0	6.4	7.5				
(2)	**223**	**209**	**223**	**216**	**199**	**198**	**271**	**210**‖	*232	226	173	154	193	204	234	179	173				3,863
Smith, G. L. A.	6.9	6.8	6.3	6.8	6.9	5.9	8.1	6.8‖	4.4	5.2	6.4	6.9	7.3	5.4							
(7)	**231**	**253**	**196**	**209**	**252**	**209**	**218**	**214**‖	69	*231	148	125	171	206							3,107
Department of	6.0	6.4	6.5	5.8	6.4	6.0	6.6‖	8.0	6.2	6.1	6.1	6.8	5.6	6.0	6.0	7.2	6.1	6.5	7.2		
Agriculture (4)	**190**	**214**	**247**	**204**	**190**	**193**	**180**‖	151	135	*197	96	161	212	73	115	123	117	149	161		3,377
Mitchell, M. S.	7.7	6.6	7.9	6.0	6.4‖	5.5	5.0	4.5	6.3	5.6	6.6	6.2	6.1	5.5	5.5	6.0	5.2				
(9)	**214**	**255**	**206**	**198**	**244**‖	239	136	167	143	177	170	131	138	143	100	167	217				3,215
Walker, G. A. .	6.7	7.7	5.7	5.7	6.4‖	6.2	4.7	5.4	6.3	6.0	5.2	5.4	6.0	5.3	5.1						
(1)	**266**	**264**	**220**	**249**	**208**‖	152	261	238	*280	*250	213	269	*274	222	134						4,136
Rhode Island Reds																					
Batkin, L. ..	6.1	5.7	7.2	5.7	7.1‖	6.2	5.3	6.0	5.8	5.5	5.5	6.8	5.7	7.4	5.3	5.1	5.8	5.9	6.4		
(12)	**204**	**245**	**192**	**198**	**206**‖	136	218	142	176	238	165	89	161	111	180	150	110	*208	66		3,402
Salisbury's Ltd.	6.7‖	5.4	5.4	6.0	7.6	4.6	6.3	6.8	5.2	5.4	5.4	6.4	5.0	7.0	5.6						
(11)	**189**‖	46	124	165	103	154	166	178	129	162	115	*194	210	117	213						2,622
Barred Rocks																					
Bedford, L. G.	6.1	5.7	5.7	6.4	5.9‖	7.0	5.8	6.2	5.4	6.0	5.1	5.5	5.8	5.1	5.6	5.1	3.7				
(10)	**207**	**182**	**242**	**206**	**194**‖	167	157	154	167	167	163	207	112	195	137	185	104				3,168
White Leghorns																					
Burton, J. ..	4.8	4.8	5.3	5.5	4.7	5.0	5.2	4.9	4.8	4.7‖	3.6	5.0	4.1	4.3	4.2	4.4	4.8	5.1	5.1		
(16)	**228**	**224**	**230**	**188**	**191**	**192**	**208**	**214**	**192**	**217**‖	174	*195	209	177	212	194	131	145	177		3,852
Chamberlain,	4.9	4.7	5.6	4.7	5.0	5.2	5.7	4.7‖	4.6	4.4	5.0	4.6	4.6	5.0	5.6	5.5					
D. K. (28)	**186**	**216**	**196**	**205**	**199**	**196**	**186**	**240**‖	208	191	157	199	172	155	139	164					3,428
Hope, M. R. ..	5.1	5.6	4.7	4.8	4.9	5.2‖	5.6	4.3	5.7	5.2	4.0	4.6	5.3	4.6	4.4	4.8	4.1	5.0	4.5		
(14)	**231**	**238**	**212**	**196**	**191**	**227**‖	34	207	169	157	109	161	168	185	214	175	204	176	164		3,426
Phare, J. R. ..	4.7	5.7	5.6	5.2	4.7	5.4‖	4.9	5.4	4.8	5.0	5.2	4.8	4.9	5.4	5.2	4.8					
(22)	**222**	**180**	**209**	**190**	**213**	**198**‖	174	110	147	142	176	168	164	66	159	188					2,894
Walker, G. A. .	5.2	4.7	5.0	5.4	5.0	4.9‖	4.7	5.6	4.5	5.3	4.4	5.1	4.4	5.2	4.7	4.7	5.5				
(13)	**197**	**207**	**225**	**209**	**186**	**187**‖	168	160	101	143	143	151	175	171	145	161	144				2,998
Section B ..	5.4	4.7	5.7	5.1	5.0	5.5‖	5.8	4.7	3.3	4.8	5.1	6.0	5.0								
(15)	**192**	**187**	**213**	**217**	**187**	**198**‖	*184	175	51	*207	168	134	126								2,641
Section B ..	4.8	4.8	4.9	5.1	5.2	5.0‖	3.8	5.0	4.4	4.4	5.2	4.9	4.5	5.3							
(19)	**205**	**204**	**210**	**199**	**199**	**238**‖	100	173	184	198	*244	138	119	50							2,649
Section B ..	5.2	5.1	5.8	5.6	5.1	5.0‖	4.4	4.5	5.0	4.3	4.3	3.9	4.5	4.2	5.3	5.2	4.4				
(24)	**191**	**233**	**182**	**202**	**184**	**214**‖	179	166	176	156	159	149	223	223	*212	121	102				3,360
Lim, N. P. ..	5.7	5.3	5.0	4.7	5.0‖	4.3	5.2	6.4	5.5	4.6	6.0	6.4	5.6	5.6	5.9						
(25)	**203**	**225**	**239**	**198**	**196**‖	234	177	178	157	207	2	174	175	108	165						3,249
Wade, G. W. ..	5.1	5.1	5.2	4.8	5.0‖	4.8	4.9	4.5	4.5	4.4	4.6	5.0	3.9	5.0	4.8	4.5	5.6	4.0	4.4	5.1	
(17)	**202**	**180**	**188**	**211**	**184**‖	196	*196	166	151	236	241	167	165	167	175	179	*193	229	203	*222	3,872
Section B ..	4.8	4.8	4.8	5.4	4.9‖	4.4	4.7	3.9	4.7	4.9	4.3	4.1	4.0	5.1	4.4	4.7	4.4				
(18)	**199**	**209**	**183**	**197**	**180**‖	188	152	128	149	171	193	178	219	157	200	*181	165				3,277
Section B ..	5.7	5.4	6.2	5.4	5.4‖	5.3	5.4	4.5	5.4	4.3	4.5	5.7	4.6	6.1	4.6						
(20)	**223**	**211**	**181**	**205**	**213**‖	170	173	181	168	230	231	148	219	171	162						3,215
Section B ..	5.2	4.9	5.3	4.8	4.7‖	4.5	4.8	4.4	4.5	4.5	4.1	5.4	4.5	4.5	5.0	4.2	4.6	4.5	4.5	4.2	
(21)	**210**	**185**	**230**	**188**	**190**‖	208	177	150	166	196	237	131	162	202	173	170	113	233	148	181	3,671
Brown, E. ..	5.3	5.5	5.2	5.7‖	4.7	5.4	4.9	5.2	6.1	4.7	4.6	5.3	4.6	6.0							
(31)	**249**	**227**	**214**	**204**‖	95	163	*233	144	126	176	174	135	207	170							2,657
Bradley, C. L. .	5.5	4.8	4.9‖	4.7	4.3	4.2	4.0	4.3	4.6	4.6	4.6	5.0	3.8	4.7	5.2	4.3	4.6	4.3			
(23)	**234**	**231**	**226**‖	*237	138	178	208	212	187	160	180	130	203	*184	165	207	139	225			3,550
Ryde, B. F. ..	5.3	6.0	5.4‖	5.2	5.3	5.3	4.4	4.8	5.2	5.4	4.7	4.5	4.4	4.5	4.0	4.9					
(30)	**198**	**183**	**198**‖	156	178	157	19	135	173	155	179	198	151	187	198	161					2,866
Parkinson, C.	5.3	5.0‖	4.2	5.2	4.0	5.4	5.1	5.4	4.7	5.4	5.1	4.6	5.8	4.9	5.8	5.4					
and E. (26)	**218**	**189**‖	191	162	227	172	164	188	175	202	120	52	138	158	173	171					3,059
Section B ..	4.7	5.2‖	4.6	3.5	4.4	3.8	4.6	4.2	4.6	3.6	4.0	4.8	3.6	4.8							
(29)	**209**	**211**‖	214	87	136	99	108	34	217	29	166	145	121	155							2,187
Salisbury's Ltd.	4.7‖	4.5	4.1	4.6	4.5	4.4	4.5	4.0	5.5	4.3	4.6	4.7	4.5	5.7	4.0	5.0	4.8	4.3			
(27)	**204**‖	182	169	146	160	156	161	158	153	118	191	195	199	188	124	161	169	171			3,298

* Egg size unsatisfactory.

Only birds alive at the end of the trial are recorded. All figures for egg production shown in heavy type and to the left of vertical lines are for accredited breeding birds.

512—BREEDERS' LAYING TRIAL . . .

Pen No.	No. of birds alive at end of trial	Total eggs produced	Flock-housed average based on 20 pullets
	Heavy Breeds (Section A)		
1	.. 17	4,136	206.8
8	.. 19	4,027	201.3
2	.. 17	3,863	193.1
3	.. 19	3,847	192.3
6	.. 19	3,554	177.7
5	.. 16	3,480	174.0
12	.. 19	3,402	170.1
4	.. 20	3,377	168.8
9	.. 17	3,215	160.7
10	.. 17	3,168	158.4
7	.. 14	3,107	155.3
11	.. 15	2,622	131.1
	Light Breeds (Section A)		
17	.. 20	3,872	193.6
16	.. 19	3,852	192.6
23	.. 18	3,550	177.5
28	.. 16	3,428	171.4
14	.. 19	3,426	171.3
27	.. 18	3,298	164.9
25	.. 15	3,249	162.4
26	.. 17	3,059	152.9
13	.. 16	2,998	149.9
22	.. 16	2,894	144.7
30	.. 16	2,866	143.3
31	.. 14	2,657	132.8
	Light Breeds (Section B)		
21	.. 20	3,671	183.5
24	.. 17	3,360	168.0
18	.. 17	3,277	163.8
20	.. 15	3,215	160.7
19	.. 15	2,649	132.4
15	.. 13	2,641	132.0
29	.. 14	2,187	109.0

The flock-housed average production with comparable figures for the previous three trials were:—

	1949-50	1950-51	1951-52	1952-53
Heavy breeds	149.6	175.0	178.2	174.2
Light breeds	152.6	151.3	167.7	158.2

(Flock-housed average equals the total eggs produced divided by the original number of birds penned.)

The percentage egg production for each period of the trial gives a comparison of rate of production at different periods of the year of heavy and light breeds.

Period	Percentage egg production Heavy breeds	 Light breeds
1 (February-March) ..	41.5	35.9
2 (March)	36.6	28.5
3 (April)	41.8	36.3
4 (May)	51.0	38.4
5 (June)	51.0	33.3
6 (July)	55.9	44.3
7 (August)	68.6	63.4
8 (September) ..	72.9	70.1
9 (October)	67.5	69.4
10 (November) ..	65.3	69.2
11 (December)	57.2	61.4
12 (January)	54.2	63.0

Ground was lost last year in the second period with both heavy and light breeds, the former recovering far more quickly than the latter, which were badly affected by moulting.

Unrecorded Eggs

The number of unrecorded eggs is always of interest to those who have some doubts about the complete efficiency of trap nesting as compared with the single pen bird system. It it satisfactory that in the breeders' laying trials there has been a steady decrease in unrecorded eggs.

PERCENTAGE OF UNRECORDED EGGS

	1949-50	1950-51	1951-52	1952-53
Heavy breeds	3.1	3.0	1.9	0.9
Light breeds	3.1	2.5	1.2	0.7

Food Consumption and Costs

The average quantities of mash and grain consumed per bird for all birds in the trial, together with comparable figures for previous trials, were:—

	1949-50 lb.	1950-51 lb.	1951-52 lb.	1952-53 lb.
Mash ..	41.5	45.6	47.9	42.4
Grain ..	47.5	47.1	46.2	46.7
Totals	89.0	92.7	94.1	89.1

Over the 4 years food consumption has been comparatively consistent in total and for mash and grain. The highest figure for mash consumption, 47.9lb. in 1951-52, corresponds to the highest average egg production in the 4 years.

The average cost of feeding a pullet during the 48 weeks of the trial was £1 3s. 10d., an increase of 8d. compared with the previous trial. The costs for 4 years are as follows:—

	1949-50 s. d.	1950-51 s. d.	1951-52 s. d.	1952-53 s. d.
Average cost of feed per pullet ..	15 8	18 2	23 2	23 10

For the benefit of those who may wish to make comparisons of costs with food prices in other districts the prices of the mash and grain mixture fed at the trial were:—

	Per lb. d.	Per ton (2000lb.) £ s. d.
Mash	3.29	27 8 4
Grain	3.16	26 6 8

These figures included a charge for feeding oil incorporated with the mash and represent costs at March 1953 of food delivered at the Poultry Demonstration Plant, Upper Hutt.

Mortality

Though there was a decrease in the mortality among heavy breed pullets compared with the 1951-52 trial, losses among White Leghorns showed an increase. Figures for the 4 years are:—

PERCENTAGE MORTALITY

	1949-50	1950-51	1951-52	1952-53
Heavy breed	12.5	10.8	19.4	12.9
Light breed	18.1	16.2	14.4	17.1

As in the previous year all birds removed from the pens were sent to the Department of Agriculture's Animal Research Station, Wallaceville, for post-mortem examination. A summary of the causes of death is set out below. Again avian leucosis was responsible for the most deaths.

Cause of death	Heavy breed	Light breed
Avian leucosis	13	23
Coccidiosis (intestinal) ..	1	14
Roundworms	3	5
Egg peritonitis	2	2
Impaction of gizzard ..	2	2
Tumours	1	2
Cystic oviduct	1	2
Vent pecked	1	1
Ruptured liver	1	1
Congestion of intestines ..	1	1
Sour crop	—	1
Abscess of lung	1	—
Cystic kidney	—	1
Bumblefoot	—	1
Heart failure	1	—
Infection of eye	—	1
No significant findings ..	3	8
	31	65

Two pens completed the trial with 20 pullets alive, and 6 pens lost only 1 bird during the 48 weeks. Liveability in stock is of the greatest importance and all breeders should recognise that it is a factor in poultry husbandry.

Latest Trial

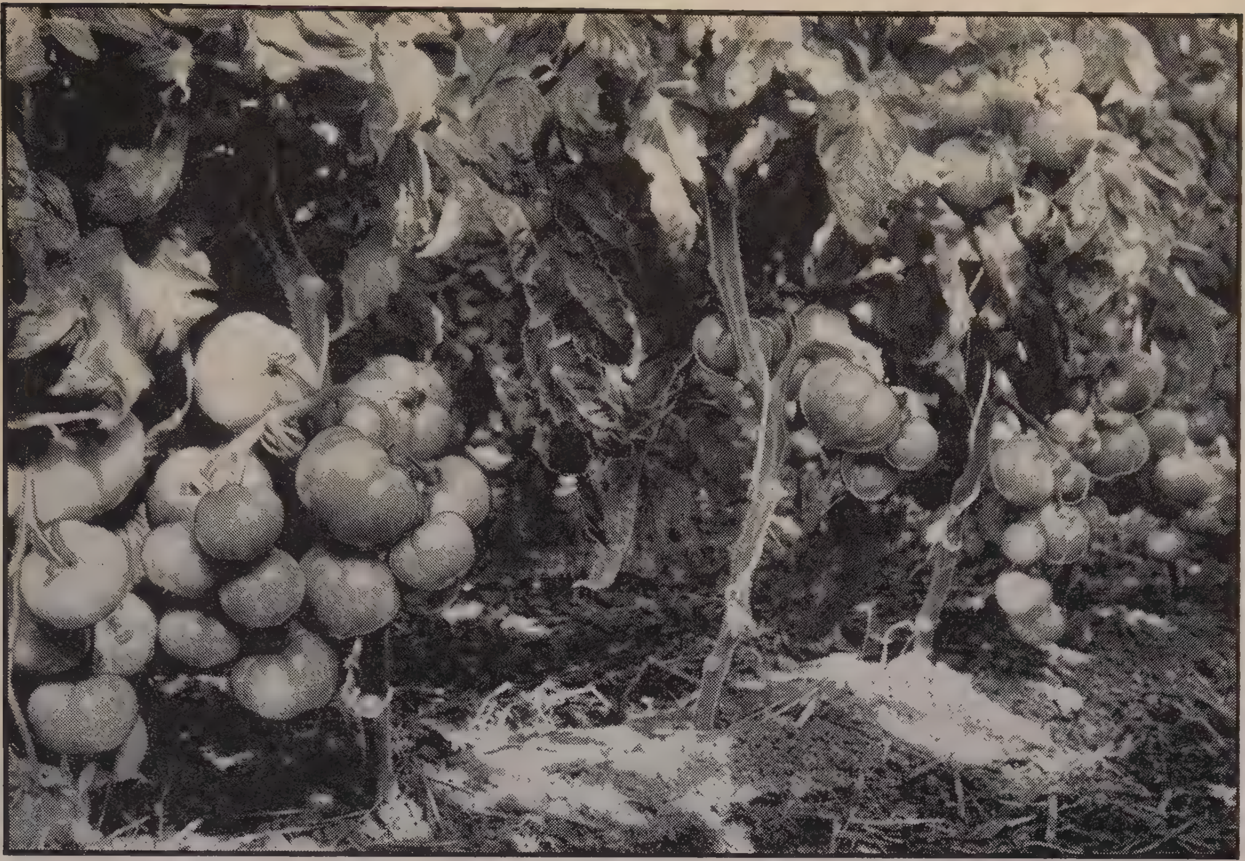
Twenty-six pens each of 20 pullets are now under test in the 1953-54 breeders' laying trial at the Department of Agriculture Poultry Demonstration Plant, Upper Hutt. The trial is held essentially to find prospective breeding stock. This year's entries comprise 14 pens of White Leghorns, 9 pens of Australorps, 2 pens of Rhode Island Reds, and 1 pen of Black Orpingtons.

At the 1951-52 trial 16 pens of White Leghorns and 8 pens of Australorps were entered. The first trial, in which there were 8 pens of White Leghorns, 6 pens of Australorps, and 1 pen of Barred Rocks, ended on 28 March 1949.

* * *

Meteorological Records for April

Station	Height of station above M.S.L. (ft.)	Air temperatures in degrees (Fahrenheit)				Rainfall in inches					Bright sunshine hours
				Absolute maximum and minimum					Maximum fall		
		Approx. mean	Difference from normal	Maximum	Minimum	Total fall	No. of days of rain	Difference from normal	Amount	Date	
Kerikeri	201	61.0	— 0.1	76.3	41.5	4.03	16	— 1.57	1.59	30	139.8
Auckland	160	61.9	+ 0.6	72.9	47.6	8.27	22	+ 3.88	2.83	30	131.3
Tauranga	10	58.5	+ 0.0	71.7	37.6	7.11	14	+ 2.09	2.88	30	139.1
Ruakura	131	56.9	+ 0.3	70.8	33.7	5.97	19	+ 2.23	1.77	30	118.6
Rotorua	969	56.0	+ 0.6	70.5	31.5	5.59	12	+ 0.96	1.94	30	125.9
Gisborne	12	58.1	— 0.3	75.2	33.7	3.51	13	— 0.15	1.20	4	179.8
New Plymouth ..	160	57.2	— 0.9	69.5	39.9	3.09	15	— 1.69	0.87	30	120.8
Napier	5	58.8	+ 0.3	78.0	34.3	4.12	11	+ 1.49	1.06	2	161.4
Karioi	2125	50.2	— 0.2	66.0	29.0	2.89	15	— 0.93	0.70	10	
Wanganui	72	57.6	+ 0.1	72.2	38.6	3.59	15	+ 0.79	0.54	7	128.1
Palmerston North .	110	55.3	— 1.3	71.0	32.0	2.89	18	— 0.47	0.60	6	101.8
Waingawa	350	53.8	— 0.7	70.0	31.8	4.94	18	+ 2.04	1.33	3	129.6
Wellington	415	54.3	— 1.8	66.0	41.0	4.68	16	+ 0.87	1.69	7	108.9
Nelson	5	53.2	— 0.9	69.0	34.0	1.95	9	— 1.00	1.14	6	171.3
Blenheim	12	54.8	— 1.2	72.0	33.1	2.62	8	+ 0.58	1.05	6	173.0
Hokitika	12	52.4	— 0.5	68.4	35.3	11.02	21	+ 2.19	2.88	29	128.6
Hanmer	1225	50.3	— 1.2	70.0	28.5	4.23	16	+ 0.89	0.64	3	115.9
Christchurch ..	22	52.6	— 0.9	75.1	31.9	2.85	13	+ 1.00	1.33	6	122.8
Ashburton	323	52.5	— 0.1	77.0	31.8	5.00	11	+ 2.59	1.37	29	115.8
Timaru	56	52.2	— 0.8	76.0	34.2	3.67	15	+ 2.01	0.89	6	99.0
Alexandra	520	51.6	+ 0.5	74.2	29.9	2.01	10	+ 0.66	0.73	28	126.1
Taieri	80	50.9	— 0.4	72.2	26.4	3.01	19	+ 0.91	1.33	28	77.3
Invercargill ..	0	50.0	+ 0.1	70.3	28.1	5.50	20	+ 1.78	1.41	12	114.6



Growing Tomatoes in Glasshouses

PRUNING and training, cultivation, fertiliser side dressings, harvesting, heating, and diseases and pests are described in this second part of an article on growing tomatoes in glasshouses by S. O. Gillard, Horticultural Instructor, Department of Agriculture, Auckland. The first part of the article appeared in last month's issue of the "Journal".

Plants are trained to a single stem and all laterals arising from the leaf axils are removed, the first about 3 weeks after planting. If these axillary shoots are allowed to develop too much, removal of them leaves large wounds, through which disease organisms can gain entry, and plant energy is wasted.

Removal of laterals is discontinued when plants reach the support wires, and when they have grown up to three leaves above these wires the terminal buds are removed and plants are allowed to spread out on top of the wires to form canopies, which shade the fruit and soil.

When plants are about 1ft. high the two lowest leaves are removed and below the third leaf a length of binder twine is tied with a reef knot. The loops of these knots should be large enough to allow plant stems to swell. The top ends of the twine are tied to the wires immediately overhead with bow knots, a slight sag being left in each length of twine between the plant and the wire. As plants grow the twine is twisted clockwise around them to give support and this operation finally takes up the slackness in the twine.

When the fruit in the first trusses has grown to the size of a marble all the leaves below this should be removed by snapping them off at the bases of the leaf stems. This enables air to circulate more freely around the bases of the plants, facilitates cultivation and side dressing, and makes conditions less favourable for leaf-mould infection, which usually begins on the lower leaves.

Damping

In heated houses light overhead damping daily with a fine syringe after planting out will reduce the amount of water required at the roots and reduce sappy growth induced by too much watering. As the weather becomes warmer more than one damping may be necessary, but it should be done not later than the early afternoon, because late damping leaves the plants wet and chilled for the night and predisposes them to infection by botrytis and leaf mould.

Unheated houses also require overhead damping on warm days, but it should never be done on cold, damp days. If damping is not practised, the atmosphere is likely to become too dry for natural pollination and the fruit does not swell properly.

Pollination is also aided by gently tapping the overhead wires during the middle of the day, which will cause the pollen to fly.

Fruit Setting with Hormones

It is no longer absolutely necessary to damp down the flowers or to tap the wires to aid setting. Instead trusses of flowers can be sprayed as they open with a suitable proprietary fruit-setting hormone at the strength recommended by the makers. This should be directed into the truss with an atomiser when the flowers are fully opened and bright yellow. Within a few days, often before the flowers have withered, the small fruits begin to swell. They

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HEADING PHOTOGRAPH: Plants with first trusses of fruit nearing maturity, showing how support strings are attached and bottom leaves removed. Straw is used at this stage as a mulch and is spread over all the soil surfaces including pathways. Sparrow photo.

develop steadily and are the same in colour and appearance as fruit set naturally except that they may have fewer seeds.

Although hormone sprays are best used on the open flowers from the start, they can also be used successfully to counter dry set (failure of the fruit to swell), provided they are applied shortly after the flowers have fallen.

Reasonable care should be taken to direct the spray away from the top of the plant, because young, actively growing shoots may be injured by the hormone. Equal care must be taken to wet all the truss thoroughly. The liquid must touch the base of the flower and wet the hairy calyx region.

Any flowers that have withered before the application is made should be removed carefully to allow the small fruit at the base to receive the hormone.

When some proprietary hormone preparations are mixed the hormone must be added to the water, because if the water is added to the hormone, it will cause it to froth and it cannot then be atomised and used efficiently.

Although it is not usually necessary to use hormone sprays on more than the first and second trusses, spraying later-developed trusses will ensure a complete set of fruit on each and the yield per plant may be increased considerably.

Temperature and Ventilation

In glasshouses day temperatures ranging from 70 degrees on dull days to 85 degrees on bright, sunny days, and night temperatures of 60 degrees to 65 degrees are satisfactory for tomatoes. Sudden fluctuations or very low or very high temperatures are very injurious to the crop.

Success in the growing of a tomato crop under glass is to a great extent influenced by the use of suitable houses capable of being maintained at a favourable temperature under all weather conditions. Ventilation is extremely important. Some circulation of fresh air to all plants is important even during cold weather, and this must be given without exposing them to draughts. Houses with ventilators under the eaves the full length of both sides of the house and with ridge ventilators along the full length and on both sides of the ridge come nearest to meeting optimum requirements.

After the plants are set care must be taken in ventilating. To give the plants fresh air some ventilation will be necessary during the day and this should be governed by the weather outside. The usual practice of opening the ventilators at 8 a.m. and closing them in the evening cannot always be adhered to. With unheated houses in the early part of the season it is very important that any warmth derived from sunshine during the day should be retained for as long as possible during the night and this can be done only by closing the ventilators in the early afternoon. The minimum temperature prevailing during the night can be read off a suitable thermometer the next day. If this reading is very low and the house was closed the previous day at 4 p.m., the owner should try closing the ventilators at 3.30 p.m. It is only by familiarising one's self with prevailing house temperatures that efficient ventilation likely to give the greatest benefit to the plants can be attained.

Cultivation

Hand hoeing is necessary to suppress weeds, to aerate the soil around plants, and to maintain a fine tilth.

Cultivation should be shallow to avoid injuring any plant roots growing close to the surface. It is usually done after watering to prevent caking of the surface soil.

Packing tomatoes from a double-sided electrically powered fruit-sizing machine.

Side Dressings

It is difficult to generalise about side dressings, as treatment depends to some extent on the condition of the soil. It is wise to consider the effect of different kinds of fertilisers.

Nitrogen induces darker and more luxuriant foliage and rapid growth. Its effect on the tomato depends to some extent on the conditions under which plants are grown. Softness of tissue, large leaves, and rapid growth are induced when the soil is damp and the atmosphere hot and humid. A shortage of nitrogen in the soil usually produces pale, thin plants with rapidly maturing fruit. A yellowing of the leaf tissue between the veins may develop and later the leaves may go yellow throughout. Growth at the top of the plant may become pale and weak, flowers fail to set, and top trusses fail to develop.

Phosphorus: The effect of phosphorus (usually applied as phosphate) is to increase root development and hasten fruit maturity.

Potassium: Potassium (usually applied as sulphate or muriate of potash) induces a firm, mature type of growth and helps the plant in its resistance to disease. It is essential for good colour and quality of the fruit. Too much potash, however, gives a very hard type of growth, with small, dark leaves, and small, hard fruits.

A shortage of potash may cause blotchy ripening of the fruit and produces marginal leaf scorching with a yellowing and browning which spreads finally toward the centre of the leaf until little green is left.

When young the tomato plant requires a considerable quantity of potash and only small amounts of nitrogen. As it increases in size the applications of potash should be decreased and those of nitrogen increased; finally only nitrogen is required. Tomato plants require much more potash than nitrogen during prolonged spells of dull, wet weather and the opposite in fine, sunny weather.

Suitable Food at Correct Time

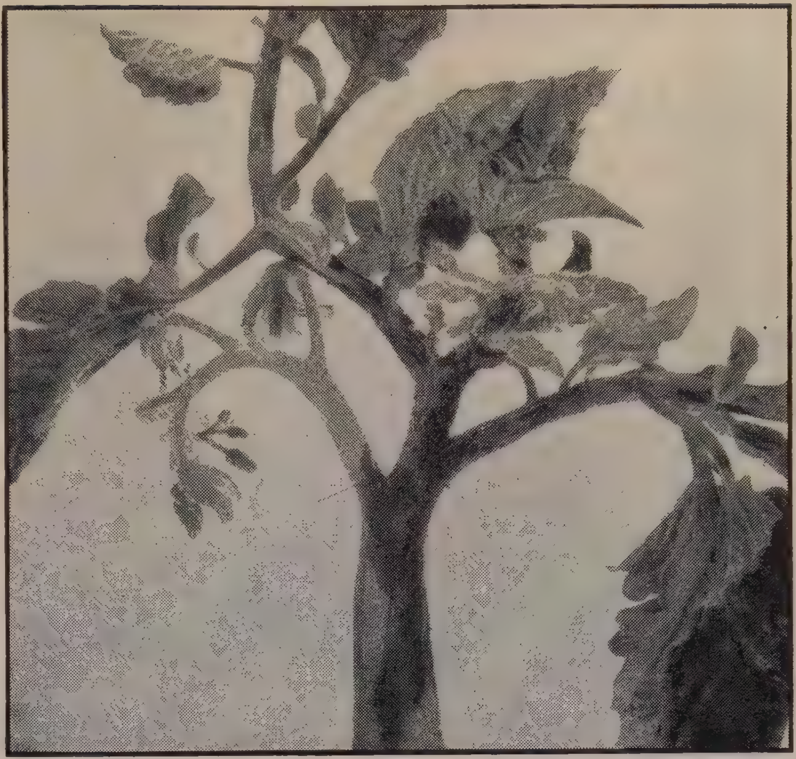
Success in the use of side dressings depends on applying a suitable food at the correct time. The amounts of the different types of fertilisers have to be governed to some extent from observation by the grower of the appearance of the plants and fruit.

The side dressings generally used for early applications contain equal parts of dried blood and "super. compound" and about 4 per cent. of sulphate of potash. For an application of 2oz. per plant to 1000 plants the following quantities are required:—

	lb.
Dried blood	60
"Super. compound"	60
Sulphate of potash	5
	125

Some growers use proprietary fertiliser mixtures conforming approximately to the above proportions, but mixtures used should vary to some extent according to particular soil requirements.

For later applications, when phosphate and potash are not required by the plants to the same extent, a nitrogenous fertiliser (dried blood, nitrate of soda, or sulphate of ammonia) is used at the rate of 1 to 2oz. per plant.



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Late blight (*Phytophthora infestans*), showing infection on stem of tomato plant.

Side dressings should be applied as often as required. Frequently this is at intervals of 14 to 21 days, beginning usually when the second truss is in full flower. They should be broadcast evenly around the plants and watered in, care being taken to keep the fertiliser off the stems and foliage.

Harvesting

The fruit is picked by breaking it away carefully from the truss at the joint nearest the calyx. Fruit is generally marketed without the calyx, which can be removed easily by rubbing it off with the thumb.

The stage of ripeness at which the fruit is picked is governed mainly by distance from markets. For local markets a good red is preferred; for longer transport the fruit must be harvested as soon as the slightest colour shows. Fruit should not be picked when it is too green, because this impairs its eating quality later and in green fruit it is not easy to detect faulty coloration. The fruit is usually picked into containers made from halved kerosene tins and these when filled are loaded on to a small trailer and transported to the packing shed.

Most large units have a tomato-sizing machine powered by an electric motor in the packing shed. When a machine of this type is used the fruit is emptied from the buckets into the hopper, where an operator directs it down a small chute to the revolving rollers, at the same time rejecting any blemished or misshapen fruit. As the fruit passes along the felt-covered rollers spray residues are removed and it is separated according to size into different bins situated directly below. The fruit is then packed by hand into standard cases, which are set out in the New Zealand Grown Vegetable Regulations 1952. For tomatoes these are:—

SPECIFICATIONS OF STANDARD PACKAGES FOR TOMATOES

Type of package	Dimensions (inside) Depth			Thickness of timber Ends			
	Depth	Width	Length	Ends	Sides	Tops	Bottoms
	in.	in.	in.	in.	in.	in.	in.
A	2½-3½	11½	18	⅝ or ¾	5/16	5/16	5/16
B	7	7	18	⅝ or ¾	5/16	5/16	5/16
C	6	9	11	½	¼	¼	¼
D	4½	12	16	⅝ or ¾	5/16	5/16	5/16
E	4½	7	18	⅝ or ¾	¼	¼	¼
F	4½	7	8¾	½	¼	¼	¼

The grading of tomatoes into various sizes before packing enables a uniform pack to be attained and considerably enhances the appearance of packages in the market.

Most growers aim to pack 20lb. of fruit into cases of types B and D, and to increase the attractiveness it is common practice to line cases with green paper. Suitably designed labels which have the net weight of fruit stamped on one corner are also placed on one end of each case by many growers.

Spray Outfits

Although a few growers still use knapsack sprayers, power outfits of two types, portable and the stationary, are commonly used. The portable type consists of a petrol engine, pump, and spray container mounted on wheels which enable it to be moved readily from place to place. This type of machine is superior to the knapsack, which is laborious to work and difficult to manoeuvre among plants.

The stationary type is made up of a pump driven by either an electric motor or internal combustion engine and is usually installed in a shed near the glasshouse. The spray mixture is pumped through galvanised pipes from a concrete mixing tank which holds a convenient quantity of spray material, usually from 100 to 500 gallons. The pipelines that carry the spray from the tank to the glasshouse are similar to those which service the glasshouse with water (usually ½in. diameter), or the same pipelines may be used for both purposes. At intervals throughout the house pipelines are fitted with hose taps, to which a length of high-pressure hose with a spray lance and nozzle can be attached. The hose needs to be about 40ft. long and is attached in turn to each tap along the pipeline. The pressures used when spraying are approximately 150lb. to the square inch; too high a pressure is likely to damage foliage or fruit.

Heating

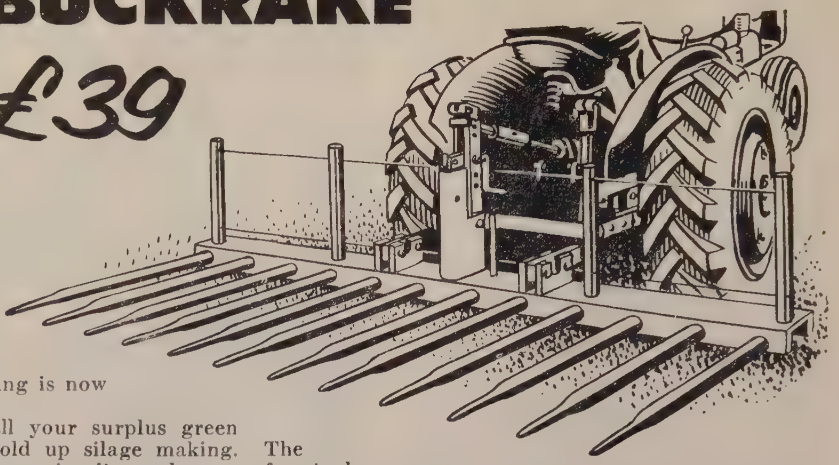
In districts where heating of tomato houses is practised hot-water heating systems are by far the most popular. Modern units are thermostatically controlled and have automatic stokers or oil firing. However, a few glasshouse boilers are still hand fired, and in some districts glasshouses are heated by portable heaters. For best results the heating system used should be capable of maintaining a uniform temperature, as substantial fluctuations may be harmful to the crop. Reasonable variations between night and day temperatures are not unduly harmful, but too frequent or severe fluctuations should be avoided whenever possible.

Details of the heating systems mainly used are given below:—

Hot-water Systems

With hot-water systems two methods are used to ensure proper circulation of water through the pipes, one being the thermo-siphon or gravity system and the other the forced-circulation system.

Thermo-siphon system: Until a few years ago this was the most common installation used in commercial heated glasshouses. The water circulates through the hot water rising to the highest point of the system and the cool water returning to the lowest point in the boiler. This type of installation is not always satisfactory,



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because pipes may have to be put at inconvenient heights to ensure that the water circulates. In addition the boiler usually has to be placed below ground level, which has disadvantages, such as inconvenience and liability to flooding. This system is not practicable when houses are more than 150ft. long, because circulation is too slow and the water cools too much before return to the boiler.

Forced-circulation system: For this a small motor pump is fitted at some point in the hot-water system. Water can be circulated much more efficiently than in the thermo-siphon system. The system is claimed to be much more satisfactory, as it gives increased efficiency in fuel usage and certainly enables the pipes to be laid at any convenient height, because water flow does not depend on gravity.

Methods of Water Heating

Sectional boilers are the most common type installed at present, but some tubular boilers are used. Tubular boilers are easier to repair, but sectional boilers probably heat the water more quickly. Both are suitable for glasshouse heating.

A boiler capable of heating up to a third more piping than there is in the system should be installed so that a reserve of heat is available to deal with exceptional weather. Soft water should be used if possible, as hard water causes scale formation, which reduces the efficiency of the boiler and hastens corrosion.

Automatic Stokers

The type of stoker usually used in New Zealand is known as the underfeed type. It feeds small coal into the bottom of the fire by an automatically controlled worm gear. Most automatic stokers are thermostatically controlled and give satisfactory results. It is claimed by some growers that the efficiency of heating and saving in labour more than offset the cost of the extra equipment. The convenience of automatic night firing is a great advantage.

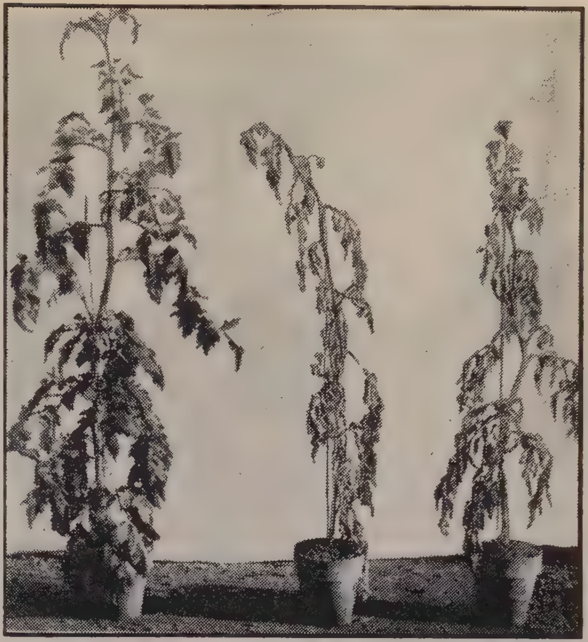
Solid fuels, coal v. coke: Fuel costs are heavy in producing crops in heated houses and therefore the fuel that will be most economical should be selected. Whether coal or coke should be used seems to depend largely on their relative availability. Coke is used by many growers and is considered as satisfactory as coal and cheaper, but it is not always readily available.

Oil v. solid fuel: Growers who have used both solid fuel and oil say that there is little difference in cost. The initial cost of oil is higher, but it costs less to handle, it is cleaner, and it is easier to store. Most oil-fired boilers are thermostatically controlled. An oil furnace requires a compresser, which is usually operated by electricity. This is a disadvantage if a power failure occurs and puts the boiler out of action at a critical time.

Thermostatic Control of Temperature

Thermostatic control of air temperature in glasshouses was originally attempted by the use of one thermostat in the glasshouse and operating on the fuel and air intake of the boiler furnace. This system was found to be unsatisfactory, because during a long period of bright sunshine, through which the fuel supply was greatly reduced, the water in the boiler and piping system cooled to a very low temperature. The result was that when the glasshouse air temperature dropped a considerable time elapsed before the water could be reheated and began to offset the outside temperature influence.

To overcome that disadvantage two thermostats are now installed, one in the centre of the glasshouse about 5ft. above ground level and one in the boiler house on the outflow pipe from the boiler. The thermostat established on the outflow pipe regulates the fuel and draught intake of the furnace to keep the temperature of the water in the boiler between 120 and 150 degrees F., irrespective of the glasshouse air temperature. This means that a supply of water at the required temperature is always available. The thermostat in the glasshouse controls the flow of water in the circulating pipes; thus when temperatures rise the circulation is stopped and when temperatures fall again circulation restarts. Dual control ensures that water at the correct temperature is always available when required for circulation through the glasshouse.



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Verticillium wilt. Healthy plant (left) and infected plants (middle and right).

Although thermostatic control is helpful, it is not sufficient and for satisfactory growth of the plants intelligent supplementary adjustment of ventilation is essential.

Control of conditions has to be related to the stage of growth, the kind of growth desired, and the prevailing weather. For tomato crops a slowly changing fresh atmosphere without draught is best. Ventilation is therefore related to heating and it is usually better to allow ventilation and use fire heat to keep up the temperature of the house than to close the ventilators and save fire heat and risk a stagnant atmosphere. During bright sunshine the temperature of the house can be allowed to rise considerably, as there is light to balance the heat, but in dull weather the temperature should be kept slightly below normal if the desired sturdy growth is to be obtained. High temperatures during dull weather, with no sunlight to balance them, tend to induce weak, soft growth.

Types and Number of Pipes Required

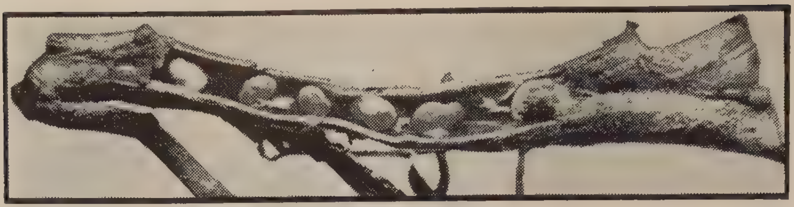
The number of rows of pipes required to heat a glasshouse depends on the climate. The installation should be capable of maintaining the minimum temperature necessary for tomatoes in the coldest weather likely to be experienced. Glasshouses 30ft. wide are usually provided with four rows of pipes, sometimes arranged with two pipes along each side wall, but preferably with four pipes more or less evenly spaced over the width of the house. Sometimes six rows of pipes (two flow and four return) are fitted.

When a circulation pump is fitted pipes 2in. in diameter may be used. Usually, however, 4in. piping is preferred. Cast iron piping is the best, but owing to shortages other types of pipe are often used. Socket joints are the easiest to make and maintain, but rubber-lined expansion joints and even screwed joints are sometimes used.

Portable Heaters

Some glasshouses are heated by portable braziers placed at intervals down the centre pathways of the houses, each having a long flue to give additional heating surface. They are fired separately by hand with coke and are usually lit in the late afternoon and kept going all night. In very severe weather they are kept going during the day also. Operating costs and initial costs of this system are very much lower than those of more modern installations. However, the heaters require a great deal of attention and excessive labour is required for firing the braziers.

Portable kerosene heaters of the ordinary round-wick type are used to some extent in the Auckland district to offset frost. Most of the commercial glasshouses in this district are unheated and as an insurance against damage from occasional frosts these heaters are very satisfactory. They are lit in late evening and are placed at intervals along each side of the house about 3ft. in from the wall, one heater to each 500 sq. ft. of house. Their fuel capacity is sufficient to keep them burning for about 8 hours.



Sclerotinia disease, showing sclerotia (or fruiting bodies of the fungus) embedded in the pith of a tomato stem.

Use of Electricity

Electricity is not economical at present costs for air heating of glasshouses. The use of electricity for soil warming, however, may become more general as power becomes available.

Diseases and Pests

Throughout New Zealand tomato plants and fruit are subject to the ill effects of certain fungous, bacterial, and virus diseases, physiological disorders, and insect pests. Their individual and/or combined capacity to damage crops constitutes a major production problem. Control is largely dependent on knowledge of, and ability to identify, the causes of injury to plants or crops.

Common diseases and pests of tomatoes grown in glasshouses are:—

Fungous Diseases

Late Blight

Late blight, caused by the fungus *Phytophthora infestans* (Mont.) de Bary, affects outdoor tomatoes and potatoes mainly, but it can cause serious damage to tomatoes grown under glass. The disease may attack plants at any stage of growth and its development is favoured by warm, wet conditions.

Late blight appears first on the leaves and leaf stalks as greenish brown to black areas. Under favourable conditions and when no control measures are taken development of the disease is rapid and stems and fruit will become infected. Fruits develop russet brown, marbled areas and eventually shrivel and turn brown.

Control: Spraying with Bordeaux mixture 3 : 4 : 50 or certified Bordeaux substitutes will give effective control of late blight, but the following factors must be considered:—

Spraying should begin when the plants are in the seedling boxes.

Applications should be made at 10-day intervals.

Complete coverage of plants is essential.

When infection appears in crops in glasshouses humidity should be kept to a minimum by providing adequate ventilation and discontinuing watering until control is obtained.

Diseased refuse should be burnt and not dug into the soil.

Verticillium Wilt

Verticillium wilt, caused by either *Verticillium albo-atrum* Reink, and Berth or by *Verticillium dahliae* Kleb., is very common in most of the tomato growing districts in New Zealand and is a major problem with glasshouse crops. Generally the disease is not noticeable until the plants have developed 3 to 5 trusses of fruit. The first indication is usually wilting of the terminal shoots, but sometimes the only visible symptoms are stunting of the plants and yellowing of the lower leaves.

In the early stages of an attack the plants may recover partially overnight, but infected plants eventually collapse, the leaves turn brown, and with severe infection plants die. The stems of infected plants will show an internal light brown discoloration and this is generally evident throughout the plants.

Verticillium wilt infection enters the plant through the roots, and the fungus can remain active in the soil for several years. The disease can be spread to clean soil by taking plants there from infected soil.

A check in growth or excessive watering can increase the severity of the disease.

Control: Disinfection of the soil both in glasshouses and seedling boxes by steam or chemicals is the only effective means of controlling this disease. If infection is slight, moulding up of plants to induce new root growth, whitewashing the glass to cause shading, and light overhead watering to allow a reduction of the amount of water applied to the soil will be helpful.

Fusarium Wilt

Fusarium wilt, caused by the fungus *Fusarium bulbigenum* Cke. and Mass., although seldom seen affecting indoor tomato crops in New Zealand, is mentioned here because the symptoms closely resemble those of verticillium wilt and the two diseases could be confused. Although the plants wilt and gradually die, the roots and bases of stems are also attacked and may turn brown or rot. The discoloration as described for verticillium wilt will be found on infected plants, but seldom extends more than 1ft. above the bases of plants. As this disease is favoured by high temperatures, it may be checked by keeping temperatures down to 65 to 70 degrees F. In addition the same control measures as for verticillium wilt should be adopted.

Sclerotinia Disease

Sclerotinia disease is caused by the fungus *Sclerotinia sclerotiorum* (Lib.) de Bary. Although it is seldom seen on glasshouse tomato crops, it could become serious, particularly in unheated glasshouses. The disease usually affects the stems of plants at some point above ground level and the affected areas become bleached in appearance. Infection is followed by wilting of the foliage and eventually plants die. If the affected portion of a stem is cut open, hard, black, irregular-shaped bodies will be found lining the hollow portion. Infected plants should be removed and burnt.

Control: Sprays are of little value in the control of this disease; the only remedy is to disinfect the soil with steam or chemicals before planting the next crop of tomatoes.

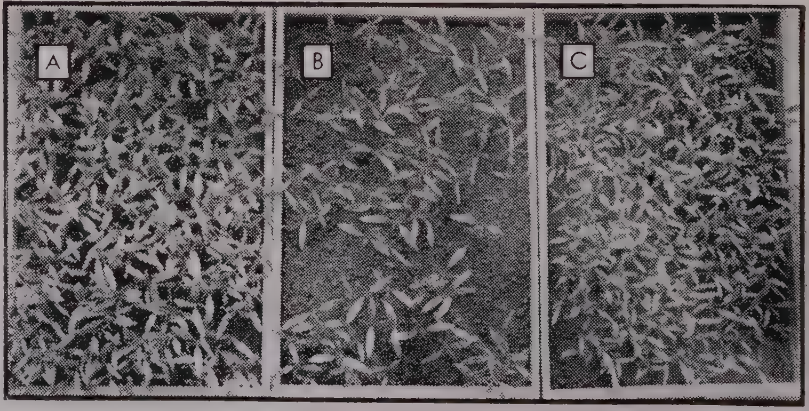
Damping off

Damping off, a fungous disease, may attack seedling plants at any stage from seed germination until plants are about 2in. in height. Infected plants show light brown water-soaked areas just above ground level and later the stems shrink, causing the plants to fall over. The disease is very rapid in its action.

Control: Effective control can be obtained by treating both potting soil and seed trays with steam or recommended chemicals.

Foot Rot

Foot rot is caused by the fungus *Phytophthora cryptogea* Pethybr. and Laff. and has in some seasons caused concern to several growers of indoor tomatoes. Infection may occur on plants in seedling boxes and after they have been set out in the glasshouse. Symptoms are browning and rotting



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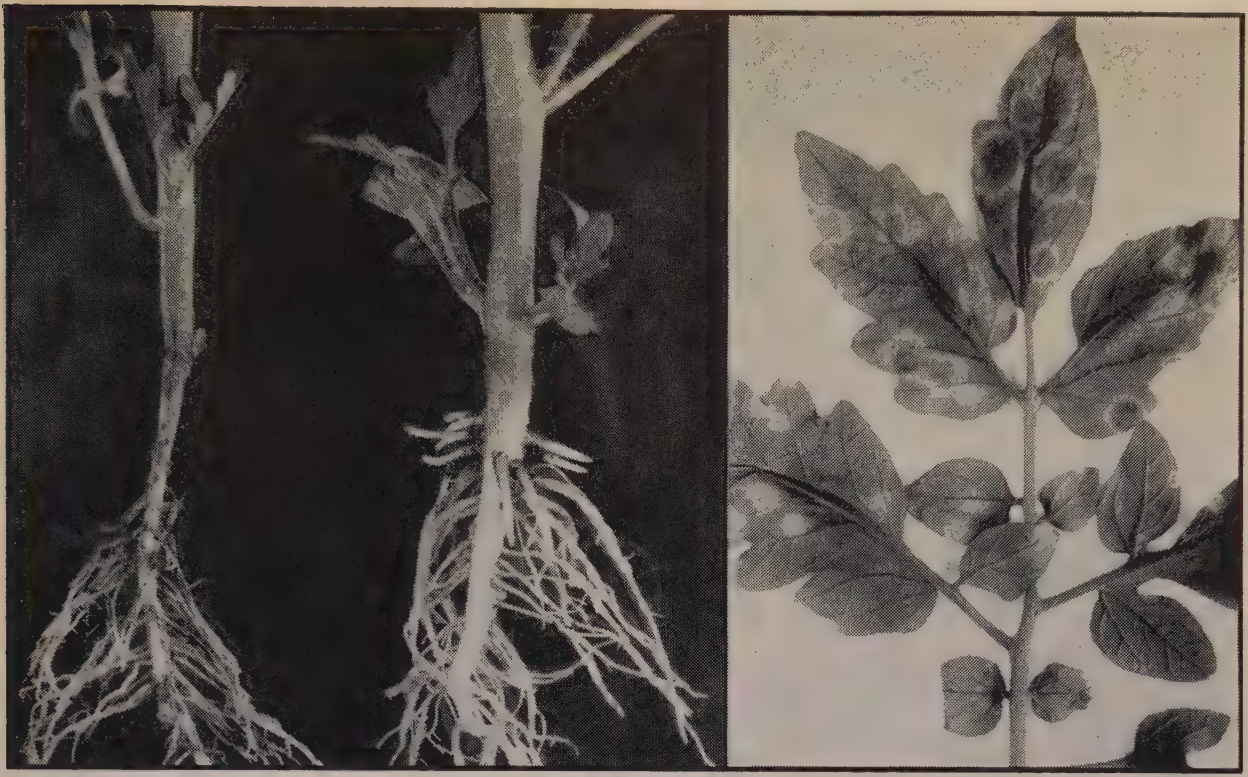
Damping off disease. Box of plants B partly destroyed by infection; boxes A and C, the soil of which had been treated, were unaffected.



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Left—Foot rot (*Phytophthora cryptogea*). Infected tomato plant (left) and healthy plant (right). Right—Tomato leaf mould (*Cladosporium fulvum*). Early infection showing on under sides of leaves.

of the bases of the stems, and rotting of the roots.

The first noticeable symptom is wilting of plants.

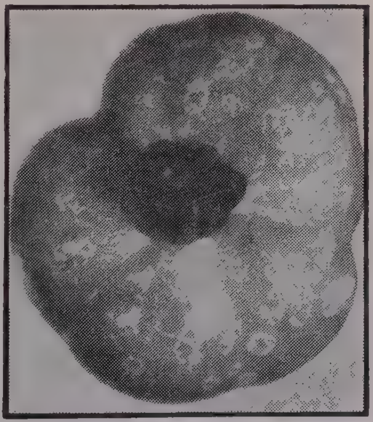
Often trouble is accentuated by wet soil causing some of the roots to decay and thus allowing the fungus to gain entry.

Control: Drainage should be improved, and to avoid further contamination of the soil, where the fungus can survive for a long time, affected plants should be dug up and burnt. Soil and boxes for the raising of plants and soil in the glasshouse should be disinfected with steam, chloropicrin, or formalin.

Leaf Mould

Leaf mould, a most troublesome disease which attacks tomatoes only, is caused by the fungus *Cladosporium fulvum* Cke. Some varieties are more susceptible to attack than others. The infection usually starts in the bottom leaves of plants and works upward, sometimes affecting blossoms and fruit trusses. When first seen the mould shows as a silvery scale on the under sides of leaves and later turns to a tawny brown. Under favourable conditions the lesions enlarge into downy white bands with velvet-like centres. The corresponding upper surfaces of leaves turn yellow, and if infection is not controlled, it will cause leaves to dry up. If flowers are attacked, they may fail to set fruit. Early infection, if uncontrolled, will materially affect production.

Control: Efficient control of leaf mould can be obtained by ventilating freely, by avoiding excessive watering, and by allowing plants ample space. Free circulation of air around plants assists in keeping down local humidity and this can be aided by removing the lower leaves up to the first truss. Spraying the plants with a certified salicylanide preparation at the recommended concentration from soon after they are set out and before the disease appears is recommended in localities where the disease is difficult to control by improving ventilation and reducing humidity.



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Grey mould marking on tomato.

Grey Mould

Grey mould or botrytis rot of tomatoes is caused by the fungus *Botrytis cinerea* Fr. and can reach serious proportions under favourable conditions on indoor tomatoes. Infection causes damage to stems, fruits, and flowers. The fungus gains entry through leaf scars and any damaged or dead tissues. On stems and leaves it appears as water-soaked, greenish brown lesions which soon develop into a greyish brown velvet-like mass. As the fungus progresses it may encircle the stem and cause the parts of the plants above the infection to die. Fruit is usually attacked at the stem or blossom end and decays rapidly. Spore masses similar to those on stems sometimes envelop the decayed fruit. Other symptoms sometimes seen on fruit and known as ghost spot are round marks about ⅛in. to ¼in. in diameter dotted over the fruit surface. These markings, although blemishing the fruit, do not cause them to decay.

Control: Reducing humidity by free ventilation and careful watering will usually control the disease. Other measures that should be adopted are pruning to avoid leaving dead tissue and broken foliage, and removal and burning of all infected material such as dead leaves and fruits, both from the plants and the ground. As the spores fly readily, it is recommended that several containers filled with equal parts of water and kerosene should be kept in the glasshouse and that the infected material should be placed in these containers to prevent

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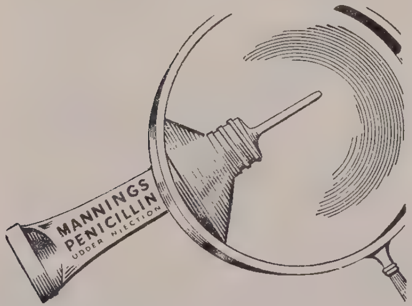

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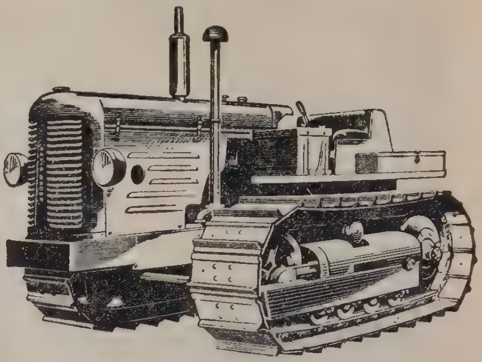

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the spores of the fungus flying and alighting on the plants. Several promising fungicides for the control of grey mould are being tested, but none can be recommended yet.

Bacterial Diseases

Tomato Canker

Tomato canker, caused by the bacterium *Xanthomonas michiganensis* (Smith) Dowson, is sometimes found on a few tomato plants in glasshouses, but so far has caused no serious loss.

The disease attacks both young and old plants. Young plants may wilt and die or remain stunted. When older plants are attacked the bottom leaves wilt and later turn brown and die and it is some time before the upper foliage of plants dies.

At first no infection shows on the stems, but as the disease progresses the stems shrink and split lengthwise. The pith becomes shrunken and dark brown and a light brown discoloration appears in the remainder of the inside of the stem. Infection may show on the skin of the fruit as white spots with rough, raised centres.

The disease is readily transmitted on seed from infected fruit, or it can be spread by watering, cultivation, or pruning.

Control: The following precautions are recommended:—

Use disease-free seed or disease-free plants.

Extract seed by acid method (see extraction of seed page 405 in last month's "Journal").

Treat seed of unknown origin with acidulated mercuric chloride.

Disinfect soil used for raising plants and soil in glasshouse.

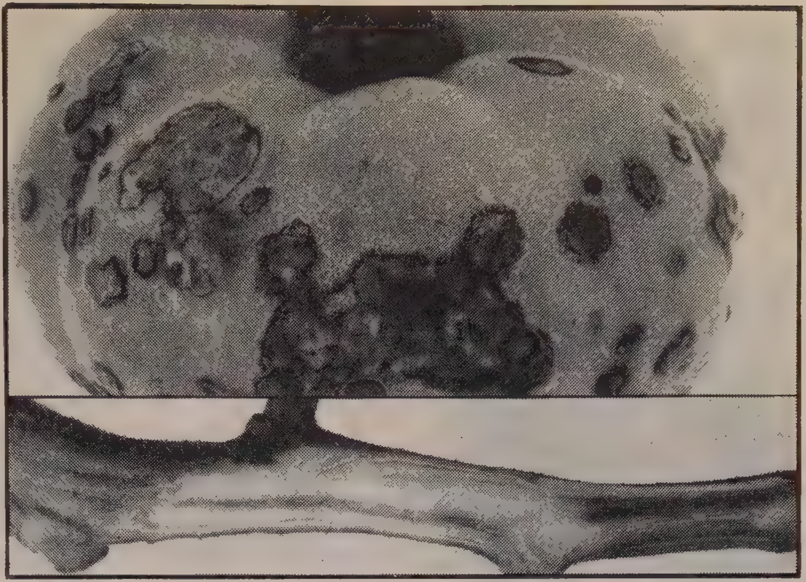
Burn any infected plants.

Tomato Speck

Tomato speck is caused by *Bacterium tomato* (Okabe) Magron and though more common on outdoor plants, where it has caused serious losses, it occasionally affects indoor plants.

The disease appears on the leaves as dark brown, rough, irregular spots about ⅛in. in diameter. Later the spots increase and the leaves become brown and dry up. Tiny, round, raised, black specks surrounded by a distinct white margin occur on the fruits. The specks remain on the surface and are not deep seated.

Control: The disease is thought to be carried on the seed and for this reason seed of doubtful origin should be treated. Seed treatment was described in the first section of this article, in last month's "Journal" (page 405). As the disease sometimes occurs on young seedlings and is easily spread by watering, care should be taken to see that the plants to be set out in the glasshouse are healthy. Other control measures are the same as for tomato canker.



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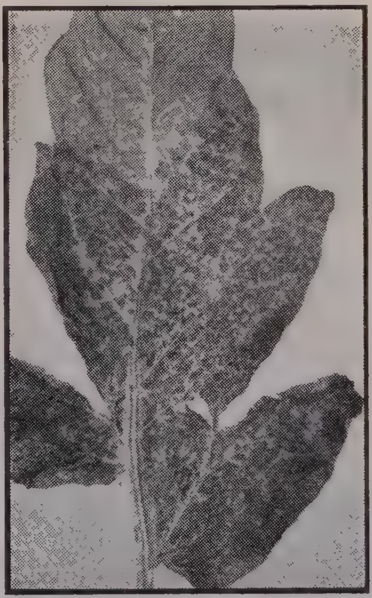
Tomato canker. Upper—Raised, scab-like markings on ripe fruit. Lower—Early infection on stem—dark staining of the vascular area and pith.



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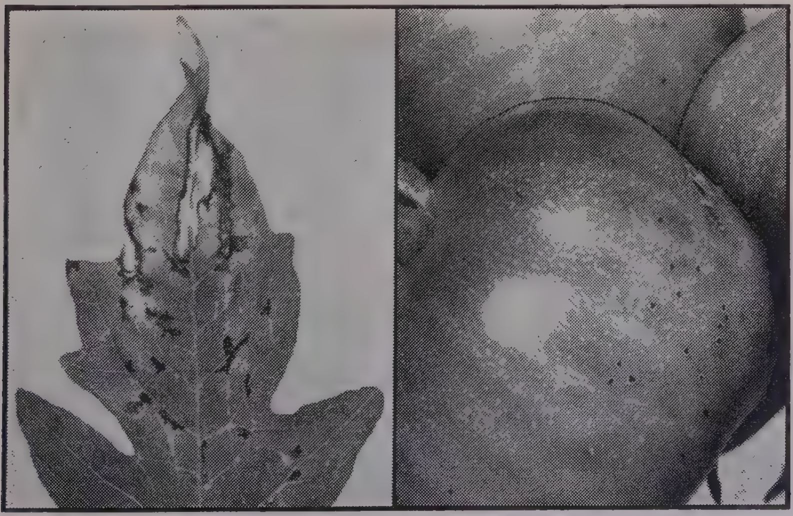
Spotted wilt (bronze top) on leaf.



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Tomato speck on leaf (left) and green fruit (right).

Virus Diseases

Tomato Spotted Wilt

Tomato spotted wilt, commonly called bronze top, is a most serious virus disease, as it often kills the plants. Infection shows first as dark, pin-point spots on the terminal shoots and leaves. The top of the plant soon becomes stunted, the young top leaves tend to curl downward, and little or no further growth is made. Irregular brown and bronze markings appear on the leaves as the disease progresses

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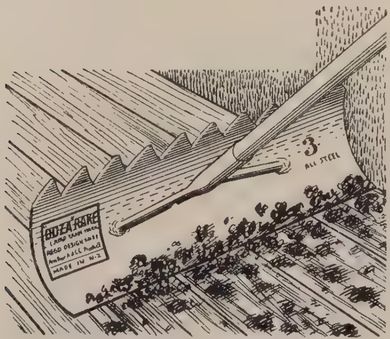

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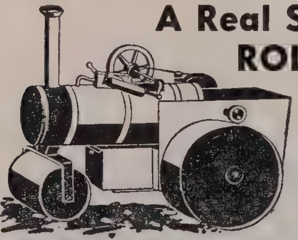

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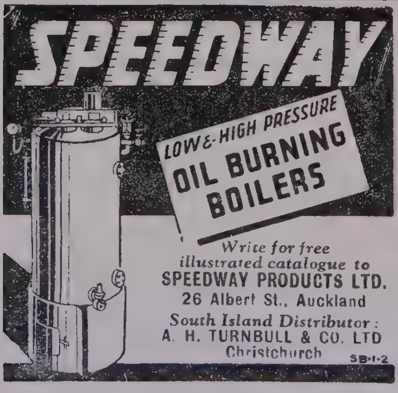

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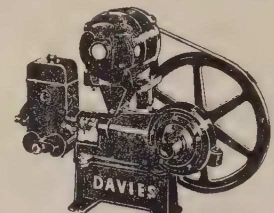

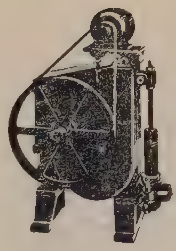

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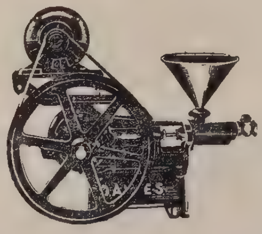

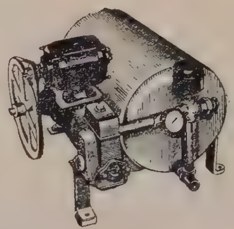

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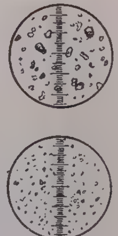

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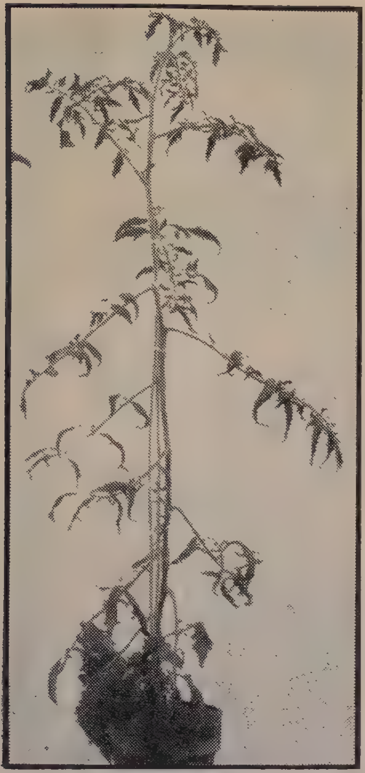

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Cucumber mosaic on tomato plant, showing narrowing and distortion of leaves.

through the system of the plant, and fruits show irregular mottling of lighter or yellowish colour or distinct concentric markings.

Control: Control measures consist of removing and destroying infected plants as soon as the disease is noticed. As the disease is spread from plant to plant by onion thrips (*Thrips tabaci*), these should be controlled by fumigating the glasshouse with nicotine sulphate (see page 526).

Cucumber Mosaic

Cucumber mosaic has not so far been of economic importance on glasshouse tomato crops. Symptoms may appear at any stage of growth, but the disease more often affects plants at the early fruit-bearing stage. It causes narrowing, distortion, and curling of the leaves, which reduce the vigour of the plant and result in the production of small, lightweight fruit.

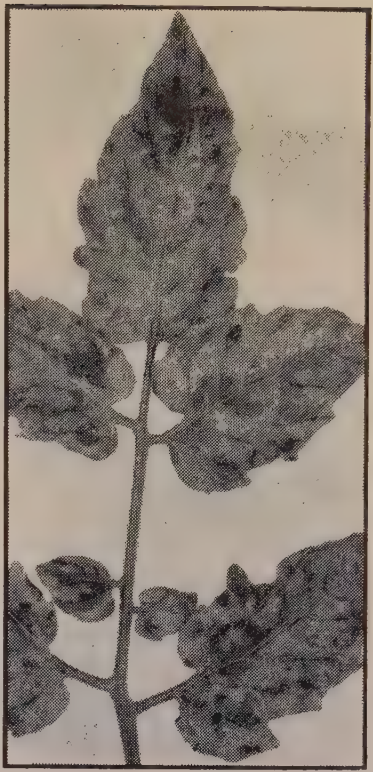
Control: The disease is most commonly spread by aphides which feed on a wide range of plants, some of which could be hosts for the virus. It can also be spread by workers during pruning. Except that healthy plants should not be handled after diseased ones until the hands have been washed with soap and water, the control methods are similar to those for spotted wilt.

Tobacco Mosaic

Tobacco mosaic is by far the commonest virus disease of glasshouse tomatoes. Although it is not as serious in its effect as spotted wilt, it can cause a fairly severe reduction in yield. The virus causes a mottling of the leaves which is sometimes accompanied by leaf distortion. The mottling shows as light yellowish green, irregular areas in the leaf-blade tissues. The fruit is sometimes affected and may show slight irregularity or "mistiness" in the red colouring. The virus may be spread by the hands from plant to plant when laterals are being removed or during tying operations. Mosaic also affects tobacco and is usually present in the manufactured product. It may be spread to tomato plants by workers who handle tobacco in rolling cigarettes.

Control: As the virus can be carried in the gelatinous coat of tomato seed, all seed saved should be acid treated.

Where the virus was present in the previous crop steam treatment of the glasshouse soil (see page 409 of last month's "Journal") is the only known remedy. This applies also to potting soils that are known to contain the virus. Where steam disinfection is not possible some control may be obtained by removing all plants, including their roots, as soon as the crop is finished and sowing the area down to maize. The maize crop should be watered freely during its growth and again after digging in to wash the virus out of the topsoil.



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Tobacco mosaic on tomato leaf.

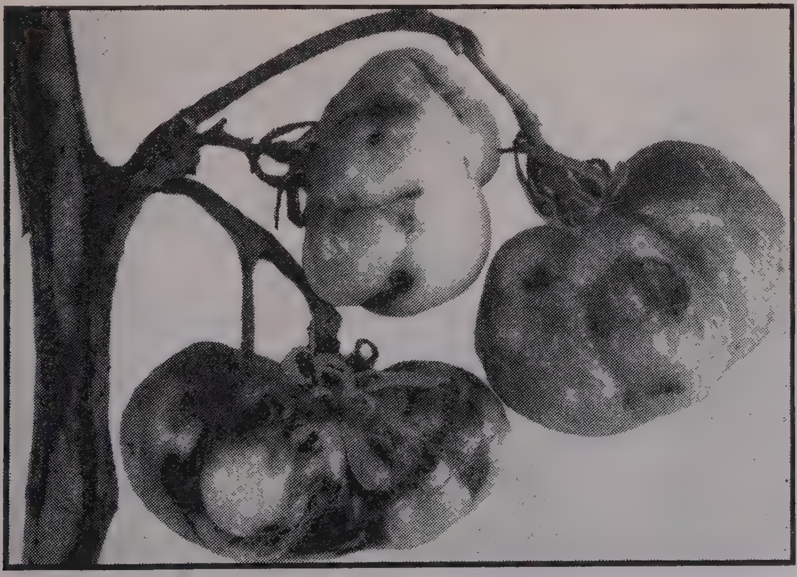
Before planting them out in the glasshouse all plants should be carefully inspected and if virus infection is visible on any the whole box of plants should be discarded.

Workers who smoke should wash their hands with soap and water before handling plants.

If only a few plants are noticed in the glasshouse, they are best removed with the soil surrounding them and replaced with fresh soil and plants.

Tomato Streak

Tomato streak is common, but although it reaches serious proportions occasionally, it is usually confined to a small percentage of the plants in any one crop. The characteristic symptoms are black streaks on the stems and leaf stalks. These later become sunken. The leaves may become brown and shrivelled and the young leaves may have a slight mosaic mottling. Symptoms usually appear when the plant is at the fourth- or fifth-truss stage. Badly infected plants are retarded in growth and usually drop a considerable amount of their foliage, and the fruits, if they set, usually have sunken areas which give them a pock-marked appearance.



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Tomato streak, showing sunken areas and markings on green fruit.

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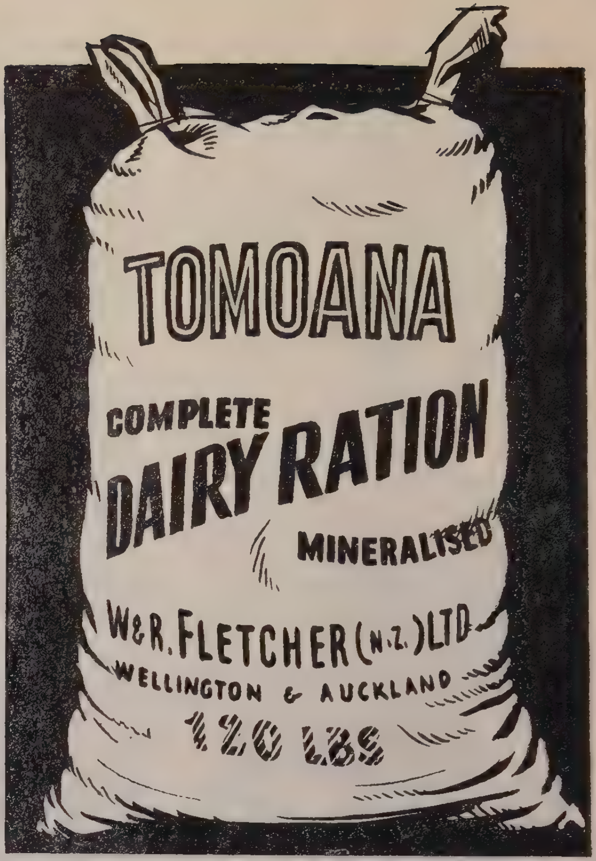

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Control: Tomato streak and tobacco mosaic are strains of the same virus and control measures are similar.

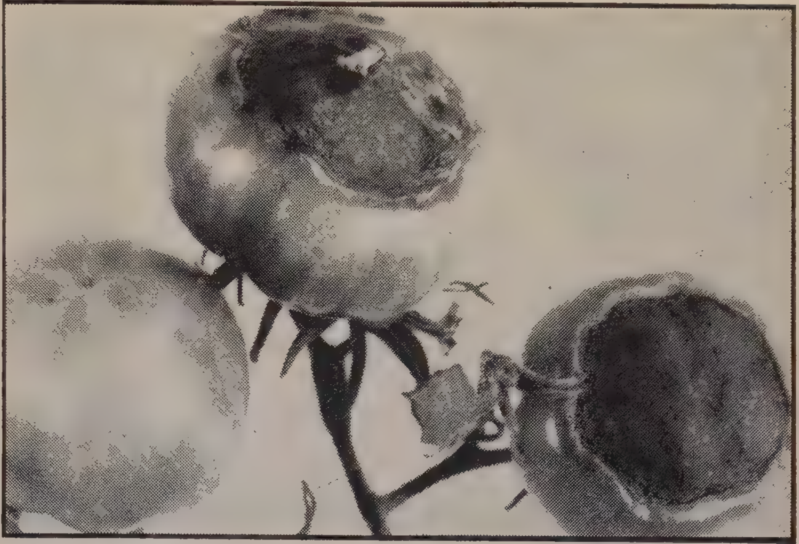
PHYSIOLOGICAL DISEASES

Physiological troubles are attributed to some cause other than living organisms or virus and are brought about by unfavourable factors in the general conditions of growth. A disturbed water supply, adverse weather, or chemical injury may produce symptoms that appear to be due to disease. Tomatoes are especially subject to several physiological conditions of this nature, and the main ones affecting them in New Zealand are described below.

Blossom-end rot

Blossom-end rot is not very common in tomatoes grown under glass and affects the fruit only. The causal agent is not disease and the condition has been attributed to sudden fluctuations in moisture, which result in the collapse of the cells at the blossom end of the fruit. Lack of water during the period of maximum fruit expansion followed by an excess of moisture appears to create the most favourable conditions for the development of blossom-end rot. In its early stages the trouble appears as a small spot at or near the blossom end of the tomato and at this stage the affected area has the appearance of a bruise, being water soaked and dark green. As the size of the affected area increases the tissues become firm, leathery, and brown to black. At times the whole of the blossom end of the fruit becomes flattened and black.

Control: Losses from blossom-end rot can be minimised by keeping an adequate moisture supply in the soil throughout the growth of the crop. Excessive use of nitrogenous fertilisers such as sulphate of ammonia or lack of lime may also cause favourable conditions for blossom-end rot.



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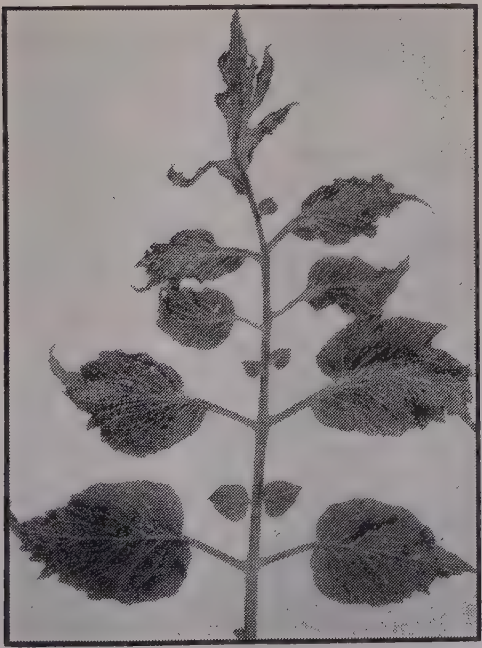
Blossom-end rot. Advanced stage, showing sunken areas on blossom ends.



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Tomato leaves showing typical 2,4-D damage.

Blotchy Ripening

Blotchy ripening, sometimes called cloud or cloudy fruit, is mainly a glasshouse trouble. It occurs in most areas in New Zealand. It usually appears on the fruit of the first truss when it is nearing maturity. Hard, dark green patches develop on the fruit at first. Underneath these patches the flesh is dark brown or black. As the fruit ripens the green patches turn yellow and are quite distinct from the bright red of the healthy tissue. This fruit, although edible, loses much of its marketable value. Botchy ripening occurs mainly when crops are heavy and usually affects the first three trusses. This condition is thought to be related to the food supply. Light, water supply, and available plant foods all seem to influence the development of the trouble, but so far it has not been possible to find out which factor or factors are the main cause.

Hollow Fruit or Puffy Fruit

Hollow fruit or puffy fruit occurs occasionally and affected fruits, because of their light weight and flabby condition, are of low market value. Affected fruits when handled are soft and flabby and when cut open have hollow pockets between the seed-bearing pulp and the outer layer of flesh. The flavour of the fruit is not affected and they keep as well as firm tomatoes, but collapse badly when packed. A somewhat similar condition can be brought about on fruit by hormones of the 2,4-D group, but such fruit is often seedless.

Control: There is no simple remedy. It appears that several factors are responsible for the development of hollow fruit. Great fluctuations in temperatures and soil moisture appear to make conditions favourable. An unbalanced plant food supply brought about by the application of large quantities of nitrogenous manures and only small quantities of phosphates may also increase this trouble. Some varieties are more susceptible than others.

Fruit Splitting

Fruit splitting has been evident in recent seasons on at least two varieties of tomatoes, Potentate particularly being affected. It is of minor importance, as it is usually confined to a few fruits on the three bottom trusses. When the fruits are very young they crack open at the side or blossom end. These cracks enlarge as the fruit grows and expose some of the partly grown seed. Tissues lining the injury become dry and hard.

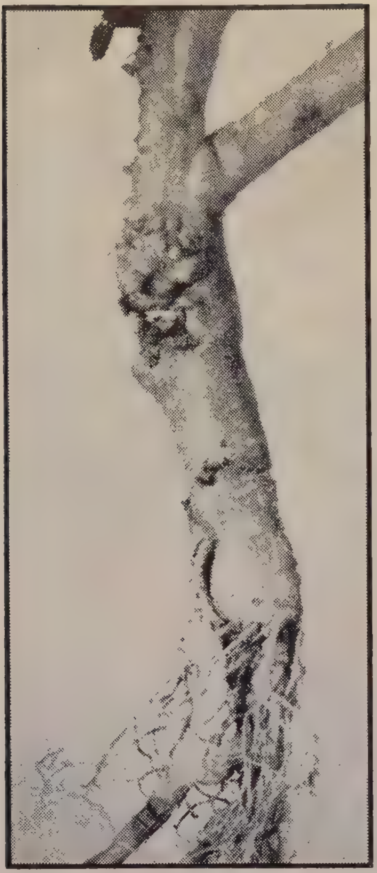
As at present the cause is unknown, no control measures can be recommended.

Leaf Twist

Leaf twist is fairly common on the Potentate variety and in some instances affects a large percentage of plants. In conjunction with the downward twisting the leaf stalks become very brittle and break off easily when handled.

The symptoms occur mainly near tops of plants and if the under sides near the bases of the leaf stalks are examined, dark, scabby streaks will be found. Stalks become very brittle and leaves will break off easily when plants are being trained. Later the trouble may disappear, possibly because of better growing conditions.

The cause of this trouble is unknown. Extra care when handling plants to avoid breaking off too many leaves will reduce damage. It has been found that plants are less likely to be damaged if work is done on them during the hottest part of the day.



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Dwarf tomato showing typical external symptoms of stem borer infestation in main stem near ground level.

Hormone Weedkiller Injury

Tomato plants are most susceptible to injury from hormone weedkillers and use of these substances close to tomatoes has in several instances caused serious damage. The first effects on the plants are spiral twisting of growing points and leaf stems and drooping of leaflets. About 2 weeks after plants have been in contact with hormones extreme narrowing and curling of affected leaves becomes apparent. Plants keep growing, but in most instances the new growth is abnormal and fruit formed is distorted and hollow.

The leaf symptoms of hormone weedkiller injury are very similar to those of cucumber mosaic (see page 523). Very minute quantities of weedkilling hormones will damage tomatoes, and injury can be brought about by drift from spray, by vapourising of volatile products used nearby, or by spraying the tomato crop with pumps previously used for weedkilling sprays.

Insect Pests

The number of insect pests which attack indoor tomato plants in New Zealand is not great, but some of them can very seriously reduce production.

Stem Borer

Stem borer (*Gnorimoschema plaesiosoma* Turn.) can become a major pest in some localities. Plants are frequently lost through the ravages of the larvae of the tomato stem-borer moth. Eggs are laid on the leaves of tomato plants and the young caterpillars tunnel into the main stems, often causing plants to collapse.

Control: D.D.D. 25 per cent. wettable powder, 1lb. in 50 gallons of water, will give control and may be combined with other sprays used on tomatoes. Applications should be made when the plants are in the seedling boxes, at which stage infestation usually occurs. Special attention should be given to see that the stems of plants receive complete coverage.

White Fly

White flies (*Trialeurodes vaporariorum* Westw.) are small sucking insects that live on the sap, and if left uncontrolled, they can cause serious damage to glasshouse plants. Heavily infested plants become unthrifty in appearance and the foliage may wither and die. When plants are disturbed the flies rise into the air in large numbers. The insects secrete a honey dew, on which develops a mould fungus that gives plants and fruit a sooty appearance.

Control: Care should be taken to ensure that white fly is not introduced on seedling plants. White fly can be controlled by spraying or fumigating with nicotine sulphate (referred to later).

Tomato Mite

Tomato mite (*Phyllocoptes lycopersici* Tryon.) appears only occasionally in glasshouse tomato crops, but if control measures are not taken, it can be very damaging to the plants and fruits. It will attack plants at all stages of growth, but is seen mainly on well-developed plants. The first visible symptom is a bronzing of the tomato stem caused by injury to the skin, and the fruit may appear rough and brown. Heavy infestation will cause the leaves of the plant to curl and dry up.

The insect is so small that it cannot be seen properly without a lens and appears to the naked eye more like a fawn dust. It multiplies rapidly and it is therefore important to control it before infestation becomes severe.

Control: To ensure control of this pest it is essential that all parts of the plants are treated, and fumigation of glasshouses with nicotine sulphate is the most effective method. In glasshouses not sufficiently airtight for fumigation spraying with nicotine sulphate is best. If the insects are noticed early, it may only be necessary to spray infested and adjoining plants. The mites can easily be carried on the clothing and care should be exercised to avoid spreading the pest in this manner.

Root Eelworm

Root eelworm (*Heterodera marioni* Cornu.) can be very damaging to tomato plants, as it will retard their growth and in severe cases will cause them to wilt badly. In some instances plants grow normally but produce only a light crop. Eelworms are difficult to see with the naked eye, but if the roots of affected plants are examined, they will be found to have numerous galls or nodules on them. These are caused by the eelworms, which live in the roots and feed on sap.

Control: Disinfection of infected soil by steam or chemicals (see pages 407, 409, and 411 of last month's "Journal") or its removal and replacement by clean soil are the only known methods of treatment.

Nicotine Sulphate Treatments

Nicotine sulphate fumigation can be used successfully to eradicate white fly and tomato mite. It is done by heating the liquid in a metal container over a small flame. One fluid ounce is required to treat 1000 cub. ft. of glasshouse space. These fumigating units should be placed so that each unit covers not more than 5000 cub. ft. Treatment is best carried out in the evening but while the glasshouse temperature is still high. All ventilators and doors should be closed beforehand. Containers holding the nicotine sulphate should be placed just above the flame and the wick of the lamp adjusted so that the liquid is volatised in about 1 hour. (See precautions below.) Next morning the house can be opened up and ventilated as usual.

The cubic capacity of the usual type of glasshouse with centre ridge may be calculated by multiplying the length by the breadth by the average height. The average height is half the sum of the height from the ground to the ridge plus the height of the outer wall.

Nicotine sulphate spray is an effective contact insecticide recommended for the eradication of white fly and tomato mite. To increase its effectiveness as a spray soft soap should be added except when it is combined with sprays containing hydrated lime. It should be used at a concentration of 1 gallon to 800 gallons of water (1 pint to 100 gallons) plus 3lb. of soft soap per 100 gallons.

Precautions

The following precautions should be observed when nicotine sulphate is used:—

1. Avoid contact of concentrate with skin or mouth and use rubber gloves if hands have open cuts.
2. Immediately wash off concentrate spilt on the skin with soap and running water. After spraying cleanse all exposed parts in a similar manner.
3. Keep insecticide out of reach of children.
4. Do not eat, drink, or smoke while spraying.
5. Leave the glasshouse if inhalation of spray vapour causes headaches and tightness of the chest.
6. When a glasshouse is being fumigated with nicotine sulphate and the lamps have been lit do not enter the house without a respirator or enter it only after it has been ventilated.

References

"Tomato Diseases and Pests in New Zealand and Their Control", by J. D. Atkinson, R. M. Brien, E. E. Chamberlain, N. Cottier, H. Jacks, W. D. Reid, and G. G. Taylor (1949).

"The Construction and Heating of Commercial Glasshouses", Bulletin No. 115 of the British Ministry of Agriculture and Fisheries.

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◆

Incubators for Lambs

MOST farmers are well acquainted with the theory of incubation. The main factors in the maintaining of life immediately after birth are first warmth and then food. Unless the newly born is well protected its temperature soon drops to a low level under natural conditions. Some animals make a nest in a sheltered spot to protect their young. One of the most interesting animals in this respect is the pig. It is on this nesting principle that modern farrowing houses have been constructed. If new-born piglets are left exposed to cold, their temperature drops very rapidly and, as one authority has stated, they shiver themselves to death. One way to overcome this loss of heat in new-born lambs is to use an incubator, and J. P. Anderson, Veterinarian, Department of Agriculture, Invercargill, here briefly describes some incubators and advises as to how they should be used.

THE lamb is born with a protective covering of wool, and most farmers agree that once the lamb is dry and has had a good drink of milk it is well on the road to survival. Protection of the lamb in spring is important. One of the theories supporting pre-lambing shearing of ewes is that the shorn ewe, particularly in the hills, will lead her lamb to shelter, whereas the ewe in full wool stands with her back to the storm and shelters her lamb as best she can. As a result, a large number of lambs in flocks on exposed country die in the first few hours of life.

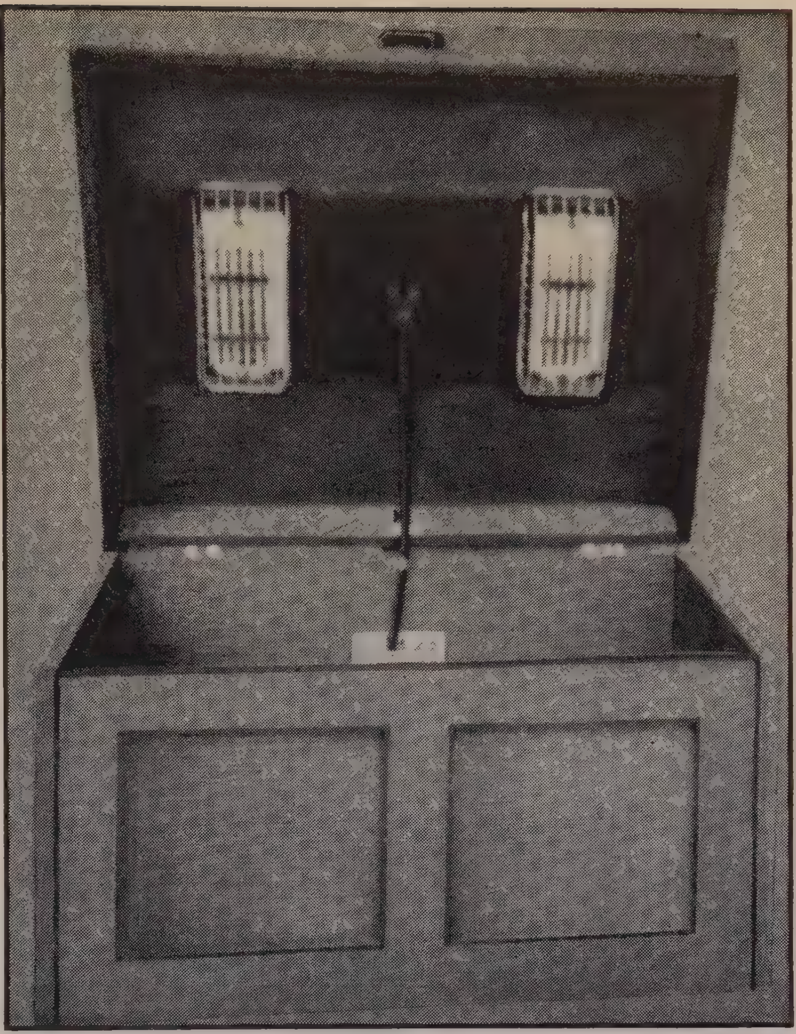
Most lambs born in Southland come from paddock ewes, and the lambing shepherd goes round the ewe flock three or four times a day. Nowadays he is usually well equipped to face most emergencies; in fact, he takes with him a veritable chemist shop, including penicillin for the ewe, glucose for the lamb, lambing oils, antiseptics, and calcium boro-gluconate. Despite all this, severe weather causes the death of many lambs.

Lambs must be given warmth to enable them to survive. The time-honoured practice is to wrap weakly lambs in a bag and warm them before the kitchen fire; the weaker ones are even put in the oven. Warmth does the rest, and with a stimulant such as glucose to help them in a few hours the lambs can be taken back to their mothers for a drink.

A few years ago a farmer's wife who had been a Karitane nurse became tired of tripping over lambs on the hearth. She thought of her nursing days, with the premature babies in their snug incubators, and got the idea of a lambing incubator.

Heating of Incubators

The principle of these incubators is very simple. Their operation is primarily dependent on controlled heat. A number of types of incubators have been developed specifically for lambs. Some are more elaborate than others.



A type of lamb incubator.

Most types today work by electricity and are thermostatically controlled. One type has been so constructed that an even temperature of 103 degrees F., which is very close to the blood heat of a normal lamb, is maintained. Others work at lower temperatures, and still others use infra-red lamps for heating.

In an emergency an electrical appliance such as a blanket, warming pad, radiator, table lamp, or portable hand lamp could be used to improvise a lamb incubator, but care would need to be taken that in its new role none is used in unsuitable surroundings such as where liability of electric shock to persons is introduced or where there is a dangerous build-up in temperature within the appliance leading to self-destruction and the possibility of fire.

Irrespective of the type of heating arrangements, the principle is excellent, provided the farmer is careful about the following points:—

1. He should not leave the lamb in the incubator for too long.

2. The less time the lamb is away from its mother the better.

Food, as well as warmth, is all-important at this stage of life. An incubator should not be used indiscriminately because it is available. It is very easy to give oneself a lot of extra work at lambing time. Good judgment is required to know when to bring a lamb in or when to leave it with its mother.

Radio Broadcasts

Radio broadcasts to farmers will be given from Station 2XP New Plymouth at 8 p.m. during July as follows:—

2 July—"Dairy Farm Improvement Groups in Taranaki", by C. J. Hamblyn, Fields Superintendent, Department of Agriculture, Palmerston North.

16 July—"Pollination", by F. A. Rodie, Apiary Instructor, Department of Agriculture, Hawera. "The Work of the Wallaceville Animal Research Station", by I. J. Cunningham, Superintendent.

23 July—"Questions and Answers on Pig Breeding", by C. M. Bailey, Supervisor, Taranaki Pig Council.

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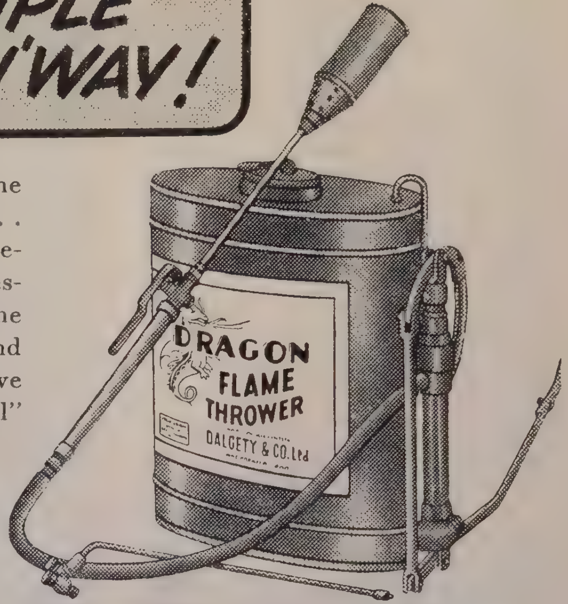

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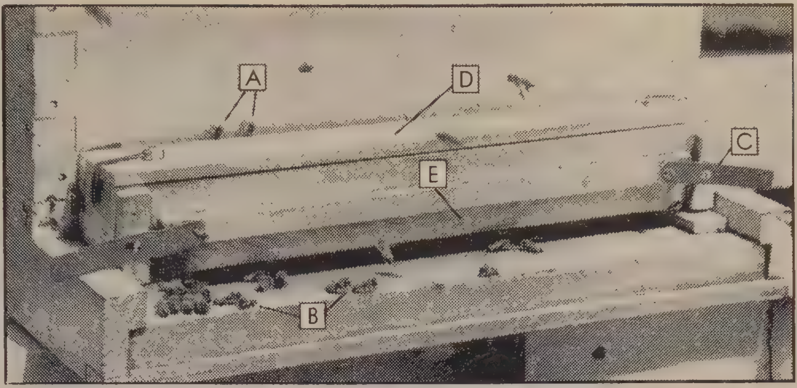
A New Method of Marking Bees

IT is frequently necessary to mark worker bees so that they can be identified as coming from a particular hive. Apiarists mark them so that robber colonies can be located and research workers have frequently found marking essential for their work, as it enables the activities of worker bees to be studied. Recently, investigations into the effect on bees of poisonous dusts and sprays used in agriculture have been helped by marking. In this article R. G. Nairn, Technician, Department of Agriculture Animal Research Station, Wallaceville, describes a simple device for marking worker bees.



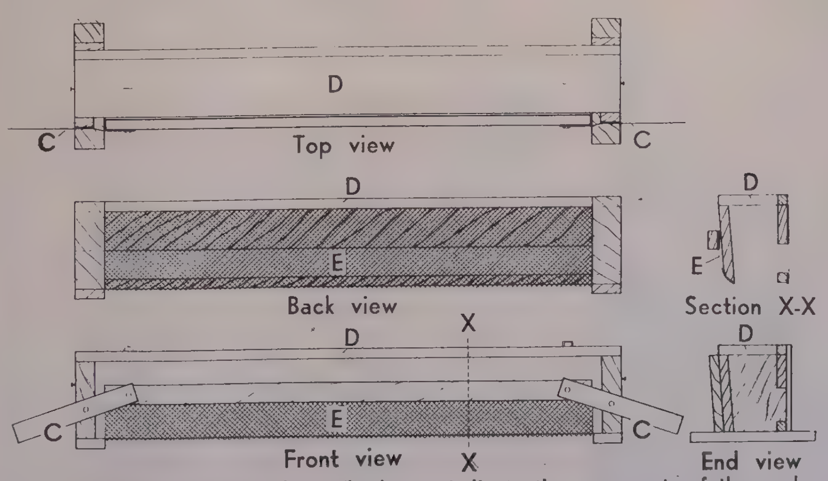
The marker fitted to the front of a hive. A—Bees leaving the hive by the vertical opening. B—Bees which have left the hive by the horizontal opening. C—One of the two levers for adjusting the net material on the bottom of the hopper. D—Removable lid of the hopper, kept in place by elastic. E—Net material on the bottom of the hopper.

THE rough and ready method of dusting robber bees with flour suffices for the beekeeper, but the research worker has relied on more precise but more complicated means, such as individual marking of bees by hand and treating bees with a fine spray containing dye. The first of these methods is too laborious for anything but a restricted scale, and the second may cause injury to the bees or disorganise the hive. Until the device described in this article was made, no satisfactory method was known for marking all the worker bees as they left the hive.

New Method Devised

Attention was focused on the problem at Wallaceville in the course of the planning of an experiment to determine the effect on bees of dusting a field with D.D.T.-superphosphate. An experimental apiary had been placed round the field, but the presence of other apiaries in the district made it necessary to show that worker bees collected in the treated area came from the experimental hives and not from other hives. After many experiments a satisfactory method was perfected for marking the bees as they left the hive.

The new method uses a wooden hopper which is attached to the front of the hive inside the bottom board so that all field bees leaving the hive are forced to crawl underneath it horizontally or emerge vertically between the back of the attachment and the wall of the hive. The bottom and the rear side of the hopper, which contains a mixture of aluminium paint powder and talcum powder, are made of cloth net. As the bees crawl past the net sufficient powder comes through the openings to mark them, particularly on the thorax. The net is fixed along the front of the device to a piece of wood which can be raised or lowered by levers at each end. In this way the horizontal area of net, with which most bees come in contact, can be adjusted to ensure that they brush against it as they leave the hive. It is advisable to accustom the bees to crawling under the net before it is lowered in the final adjustment. After passing in and out a few times the bees will readily push their way through.



Detailed drawing of the marker. The letters indicate the same parts of the marker as the equivalent letters in the top illustration.

Aluminium powder proved the most satisfactory marker because it adhered to the bees for many hours and was not toxic. Mixing it with one quarter of its volume of talcum powder helped it to run through the openings in the net. Pigments such as toluidine red were also used, but did not persist on the bees as long as aluminium powder.

The marking device is designed for a Langstroth-pattern hive with a standard bottom board, but it could easily be adjusted for use on any type of hive or bottom board.

Most bees leave the hive horizontally under the hopper of the marker and not by the vertical opening between the back of the marker and the front super. However, this opening is very useful for ventilation. The bodies of some bees which leave the hive by the horizontal route do not come in contact with the powder-laden net because they crawl through upside down. An occasional tap on the hopper with a hive tool will ensure that sufficient powder collects on the bottom board to mark these bees.

Net Material

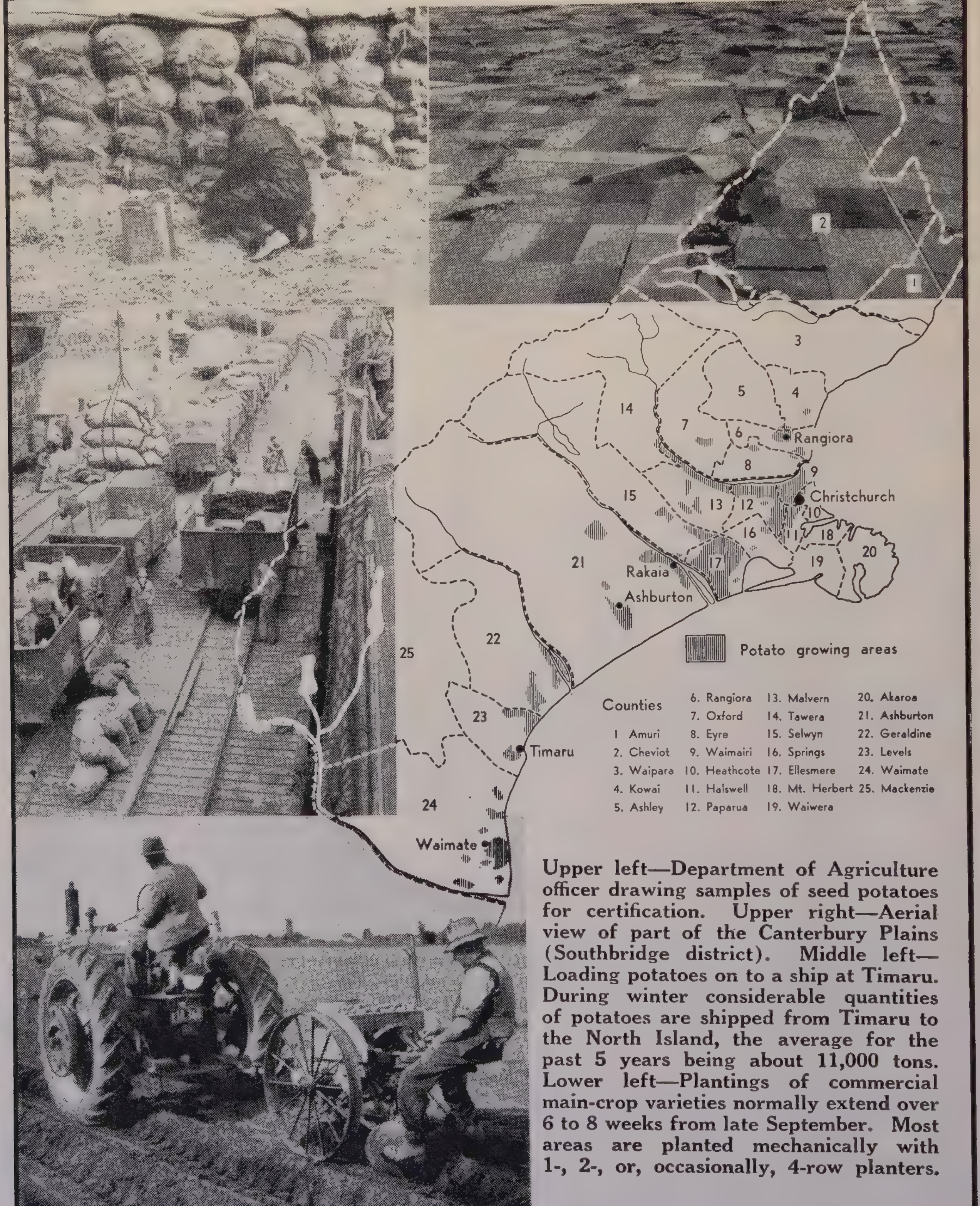
The net material is dress net or the black net commonly used for bee veils. In windy weather a double thickness of material in the bottom of the hopper is an advantage, as it prevents excess powder being blown through and wasted.

It is an advantage to paint the marker the same colour as the hive so that it will not confuse the bees.

After the marker has been attached to a hive for a short time all the field bees will be marked so that they can easily be identified for several days.

If the bees from more than one hive are marked with aluminium powder, they can be distinguished only as a group and not as coming from individual hives. Hive identification would be possible by the use of pigments such as toluidine red or, better still, by a method of dyeing the aluminium powder different colours.

POTATO GROWING IN CANTERBURY PROVINCE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Rangiora
Christchurch
Rakaia
Ashburton
Timaru
Waimate
Potato growing areas
Counties
1 Amuri
2. Cheviot
3. Waipara
4. Kowai
5. Ashley
6. Rangiora
7. Oxford
8. Eyre
9. Waimairi
10. Heathcote
11. Halswell
12. Paparua
13. Malvern
14. Tawera
15. Selwyn
16. Springs
17. Ellesmere
18. Mt. Herbert
19. Waiwera
20. Akaroa
21. Ashburton
22. Geraldine
23. Levels
24. Waimate
25. Mackenzie

Upper left—Department of Agriculture officer drawing samples of seed potatoes for certification. Upper right—Aerial view of part of the Canterbury Plains (Southbridge district). Middle left—Loading potatoes on to a ship at Timaru. During winter considerable quantities of potatoes are shipped from Timaru to the North Island, the average for the past 5 years being about 11,000 tons. Lower left—Plantings of commercial main-crop varieties normally extend over 6 to 8 weeks from late September. Most areas are planted mechanically with 1-, 2-, or, occasionally, 4-row planters.

Main-crop Potato Production in Canterbury

FOR many years before the 1944-45 season the average acreage of potatoes in New Zealand was approximately 22,000. In that season, owing to war needs, a peak acreage of 29,700 was reached, this being followed by an average acreage of 20,200 until 1950-51, when the low figure of 16,800 was recorded. This was eclipsed in the following year with an acreage of 13,300, which, combined with low yields, resulted in an acute shortage of potatoes. Canterbury is the main potato producing area in the Dominion and in this article A. R. Dingwall, Assistant Fields Superintendent, Department of Agriculture, Christchurch, gives some details of the industry in Canterbury and the problems associated with potato production.

NEW ZEALAND has no assured outlet for surplus potatoes nor reliable sources of alternative supplies when deficiencies occur. Australia is virtually the only overseas outlet or supplier and does not always need New Zealand's surplus nor is in a position to make good all deficiencies. Over the past 30 years imports have been necessary and available—with supplies coming usually from Australia (including Tasmania)—on several occasions, notably in 1924 (7412 tons), 1939 (1288 tons), 1942 (1507 tons), 1943 (4781 tons from U.S.A.), 1946 (8196 tons), and 1949 (3181 tons). The 1952 import requirement of 30,000 tons constitutes an import record.

Though it is not always possible to dispose profitably of surpluses, there is some export trade from time to time, mainly with Australia. There is a fairly regular, though small, export trade (it seldom accounts for more than 1500 tons per annum) with Pacific islands in "Island smalls". In addition potatoes have been exported in 1925 (4300 tons), 1926 (20,440 tons), 1933 (3559 tons), 1936 (4711 tons), 1937 (19,971 tons), 1940 (6158 tons), and 1950 (5593 tons).

Canterbury's Role

Canterbury plays a notable part in main-crop potato production in New Zealand. In the 17 years from the 1934-35 season to 1950-51 season the Land District has grown on an average 54 per cent. of New Zealand's potato acreage and produced over 58 per cent. of the total annual tonnage. The average yield of Canterbury potato crops over the same period has been 6.28 tons, approximately ½ a ton above the New Zealand average.

From May to October each year Canterbury growers supply most of the country's table potatoes, and Canterbury also provides seed for most of New Zealand's main-crop plantings and a great deal of the early-dug acreages.

TABLE I—SHIPMENT OF POTATOES (TABLE AND SEED) TO NORTH ISLAND

Year	From Lyttelton sacks*	From Timaru sacks*	Total sacks*
1948 ..	277,346	151,164	428,510
1949 ..	268,751	175,192	443,943
1950 ..	278,514	203,117	481,631
1951 ..	259,051	176,561	435,612
1952 ..	76,281	59,755	136,036

* Approximately 14 to the ton.

From Lyttelton and Timaru, the shipping outlets for Canterbury's surplus potatoes, approximately 33,000 tons per annum are sent to various parts of the North Island. In addition a considerable tonnage is shipped or railed to other South Island centres, and in years when overseas sales can be arranged for surpluses the two ports handle most of the exports. Shipments normally begin in mid-April and cease in late October.

Potato crops of Canterbury, as in all potato growing areas, fluctuate in both acreages and yields. These fluctuations, however, are due rather to variations in climate than to the effects of diseases and pest infestations to which some other potato growing areas are subject.

Canterbury Land District

The Canterbury Land District, of some 7¾ million acres of arable and pastoral farmlands, extends in a straight-line distance of over 200 miles from the Conway River in the north to the Waitaki River in the south. Eastward, the curving Pacific Ocean coastline is broken by the volcanic promontory of Banks Peninsula. About 60 to 70 miles inland and roughly parallel to the coast run the Southern Alps, a main divide of mountain ranges forming the western boundary of Canterbury.

Within this territory lies the expanse of the Canterbury Plains, a series of confluent, fan-like deltas formed from rock materials of the mountainous hinterland brought down by extensive, roughly parallel, river systems. These coastal plains begin about 25 miles north of the Waimakariri River and extend southward for approximately 130 miles, almost to Timaru. They stretch inland from the coast for about 30 to 40 miles, rising to an altitude of approximately 1500ft. and have a fairly uniform seaward slope of between 25ft. and 40ft. per mile. The wide, aggraded beds of the main, snowfed rivers—Waimakariri, Rakaia, Ashburton and Rangitata — that traverse the plains are on a level with some of the surrounding country and all the rivers, including the smaller Ashley, Selwyn, Hinds, Orari, and Opihi, are subject to sudden, high flooding.

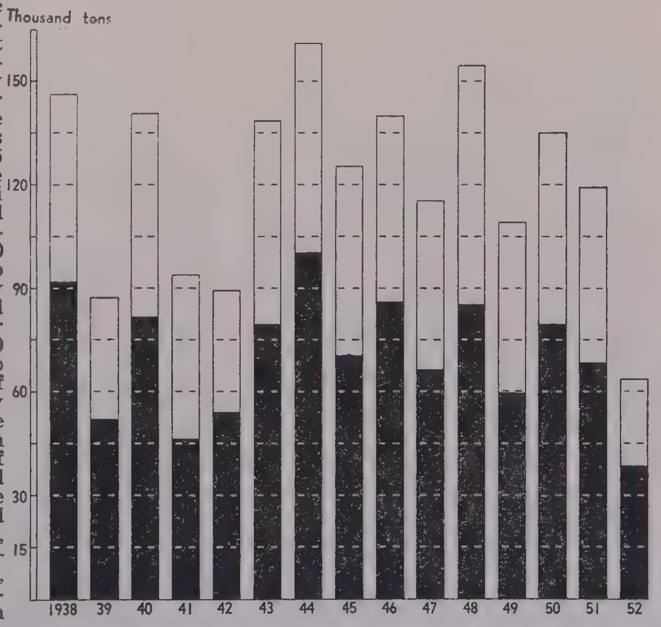
Much of the plains area consists of light and often stony, free-draining soils overlying immense gravel beds, but there are considerable areas of medium to heavy alluvial soils and appreciable areas of low-lying, high-water-table, meadow soils in coastal districts. To the north and south of the plains are extensive areas of clay downlands together with smaller inland plains and basins. Westward, plains and downlands give way to rising foothills, backed by high tussock country and snow-capped mountain ranges.

The plains and downlands of Canterbury are the home of arable farming in New Zealand, and despite the general declining trend in cropping in recent years, the area under the plough still exceeds 500,000 acres annually.

Regions

The main-crop potato production districts of Canterbury can be conveniently grouped into four regions delineated by natural river boundaries. They are the North Canterbury region—extending northward from the Waimakariri to the Conway—an area of downlands, inland plains, valleys and basins, high tussock country, and a limited extent of coastal plains; the Christchurch region—south of the Waimakariri to the Rakaia—occupying

TOTAL NEW ZEALAND PRODUCTION OF POTATOES 1938-52 AND CANTERBURY PRODUCTION (in black)



Main-crop potatoes damaged by frost. A late frost of 6 degrees or more occurring while plants are still establishing will check growth severely.

the northern section of the Canterbury Plains with limited areas of downs and foothills, but extensive high tussock country, and the volcanic hills and valleys of Banks Peninsula; the Mid-Canterbury region—from the Rakaia to the Rangitata—containing the most extensive area of relatively flat land of any region in New Zealand, and the South Canterbury region—lying between the Rangitata and the Waitaki Rivers—where coastal plains give way, to the south and west, to downs, high inland plains (the Mackenzie Plains), and mountain country.

Within these regions commercial potato growing is concentrated in a number of widely dispersed areas throughout the coastal plains and extending to some of the arable downlands and more sheltered valleys of the foothills. These areas are associated in many instances with the main river systems in near-coastal areas, where soil types, water-table levels, and climate are more favourable for reliable potato crop production than they are throughout the higher, inland areas of Canterbury.

The important potato growing districts of each region are as follows:—

North Canterbury

Most commercial crops in North Canterbury are in districts close to the Waimakariri River, which forms the southern boundary of the region. The most important districts are Kaiapoi-Clarkville (Rangiora and Eyre Counties) and Rangiora - Coldstream (Rangiora County). A small coastal area exists in the Sefton-Balcairn district (Kowai County), and inland areas occur around Eyreton and Horrelville (Eyre County) and Oxford (Oxford County).

Few commercial crops are grown in the more northerly counties of Amuri, Cheviot, and Waipara, though suitable soil types exist, particularly in the Culverden and Cheviot districts. The North Canterbury region grows approximately 10 per cent. of Canterbury's total potato acreage.

Christchurch Region

The various potato-growing districts of the Christchurch region constitute the greatest concentration of potato acreage in Canterbury. The more important growing centres include Marshland-Harewood (Waimairi County); Yaldhurst-Templeton-Prebbleton and West Melton-Halkett (Paparua County); Sheffield-Annat, Waddington-Homebush, and Coalgate (Malvern County); Leeston - Southbridge (Ellesmere County) and the Lincoln - Springston - Halswell - Taitapu district (Springs and Halswell Counties). Other important districts include Dunsandel, Hororata, Te Pirita, and Greendale (Selwyn County), Rolleston-Weedons (Paparua County), and the Heathcote-Avoca-Governor's Bay areas on the Port Hills (Heathcote County). Production in the Port Hills districts is confined largely to early-potato varieties, as the districts are comparatively frost free.

The Christchurch region grows just over half the Canterbury acreage.

Mid-Canterbury Region

The whole of the Mid-Canterbury area is included within the Ashburton County and contains three important potato growing centres, the Rakaia (from Mitcham to Dorie on the south bank of the Rakaia River), the Ashburton-Tinwald-Lagmhor districts (south of Ashburton Borough), and an inland area around Methven. Some commercial crops are also grown in the Greenstreet area to the west of Ashburton. Mid-Canterbury produces approximately 10 per cent. of the Canterbury acreage.

South Canterbury Region

The South Canterbury region possesses a number of important potato growing centres, chief of which are centred in Waimate County and include Willowbridge-Waimate-Studholme. Other important centres are Seadown-Kerrytown (Levels County) and Temuka-Winchester-Ohape, Rangitata, and Clandeboye-Belfield districts (Geraldine County). Smaller areas of potatoes are also grown in the Redcliffs, Otaio, Hook, Makikihi, Hunter, Waituna, Morven, Waihao Downs, and Elephant Hills districts (Waimate County) and on the Timaru clay downs south and west of Timaru (Levels County). South Canterbury is second only in importance to the Christchurch region in potato production in Canterbury and grows just under 30 per cent. of the province's total acreage.

TABLE 2—AVERAGE AREA IN POTATOES AND AVERAGE AREA CROPPED IN MAIN POTATO GROWING COUNTIES IN CANTERBURY

Region	Potato acreage (5-year average 1946-47 to 1950-51)	Total area cropped (5-year average 1946-47 to 1950-51)* acres
North Canterbury		
Eyre	387	15,150
Rangiora	357	8,804
Oxford	83	11,727
Others†	138	57,077
Regional total ..	965	92,758
Christchurch		
Paparua	1,501	15,481
Waimairi	1,244	4,373
Ellesmere	870	23,971
Malvern	762	35,062
Selwyn	249	15,787
Springs	223	7,314
Halswell	152	1,799
Others‡	142	3,741
Regional total ..	5,143	107,528
Mid-Canterbury		
Ashburton	938	162,580
South Canterbury		
Waimate	1,657	57,592§
Levels	560	28,807
Geraldine	459	30,540
Mackenzie	22	17,981
Regional total ..	2,698	134,920
Canterbury totals	9,744	497,786

* Excludes fallow land, but includes fodder crops.

† "Others" include Amuri, Ashley, Cheviot, Kowai, and Waipara Counties.

‡ "Others" include Heathcote, Akaroa, Mt. Herbert, Wairewa, and Tawera Counties.

§ Includes market garden areas.

Climate and Potato Growing

As the potato plant is susceptible to frost damage, especially during the early stages of establishment and growth, a frost-free period is desirable, preferably throughout the whole growing period, which for main-crop varieties is normally 20 to 24 weeks after planting. A late frost of 6 degrees or over occurring while plants are establishing will check growth severely. If frosts have not been too severe or frequent, crops have a chance of recovering, though they can be easily ruined by frosts at any time during the main growth period. Early frosts coming toward the end of the growing season will have little effect on yields if the tubers have had sufficient time to bulk up, but continued severe frosts while the crop remains in the ground or when stored tubers are inadequately protected can result in considerable loss.

Potatoes yield best in areas having a moderately high rainfall (40in. per annum), but will also yield well under comparatively low rainfall (20 to 30in. per annum) when rains are sufficiently well distributed to ensure unchecked growth for at least 14 to 16 weeks after planting. Moisture-retentive soils are a decided asset in overcoming the possible combined effects of inadequate rainfall and high evaporation during the growing period.

High-humidity Danger

Frequent rains accompanied by high temperatures and consequently high humidity occurring after the New Year may prove disadvantageous by inducing and encouraging the rapid spread of potato blight (*Phytophthora infestans*). This disease can quickly and seriously reduce the yields of saleable tubers and ruin the keeping quality of both table and seed lines. This contingency can be guarded against by early adoption of a fortnightly spraying programme, but fortunately this disease rarely attains serious proportions throughout Canterbury's commercial potato growing areas.

A severe winter climate can be advantageous in restricting the overwintering and subsequent summer development of aphis infestations. Aphides are responsible for the transmission of several plant virus diseases —leaf roll, mosaic, and crinkle—that cause the rapid running out of seed lines from crops grown in areas of high aphis populations.

Canterbury's Climate

There is comparatively little variation in climate throughout the principal potato growing areas of Canterbury. Generally, annual rainfall varies between 25 and 30in. In some coastal districts such as Studholme-Willowbridge, Morven, Temuka, and Clandeboye-Belfield the average is only 22 to 25in. and in inland areas such as Methven, Hororata, Sheffield, Springfield, and Oxford the average exceeds 30in. These inland districts are also subject to frosts of greater frequency and severity over a longer period than are coastal areas and yields may be lower and possibly less reliable. Frosts in inland areas do not affect potato yields any more adversely, however, than can droughts in areas nearer the coast where there is a much shallower soil over shingle.

In the main growing centres the period from early October to late March is reasonably free of frosts of sufficient severity to cause undue damage. Out-of-season frosts in some years do, however, result in fairly widespread damage and lowered yields.

All districts are subject to a varying extent to strong, hot, drying, northwest winds, which cause excessive evaporation of soil moisture, and, in conjunction with the relatively low rainfall, bring risks of drought during January, February, and March. The desiccating effect of these winds is particularly severe in mid-Canterbury and the districts to the north and south adjoining it. The low-lying, high-water-table, moisture-retentive soils of Kaiapoi, Marshland, Ellesmere, Temuka, and Willowbridge districts are better able to withstand these drought conditions than the freer-draining soils of other areas where commercial potato production is practised. On these moisture-retentive soils crops are more reliable and average yields usually higher.

Though the annual rainfall for the main potato growing districts of the coastal belt is low (23.5 to 28.8in.), it is well distributed, and half of the year's rainfall occurs in summer and autumn. In inland districts the annual average is approximately 5in. heavier and summer-autumn falls would average 2 to 3in. above the coastal figure.

Similarly, there are no great variations in mean air temperatures during the growing period (October to March), though inland and southern districts tend to be a little later (2 to 3 weeks) and slightly cooler than northern districts. The inland areas are also subject to colder winter temperatures with frequent frosts of between 15 and 20 degrees compared with frosts ranging from 10 to 12 degrees in coastal areas.

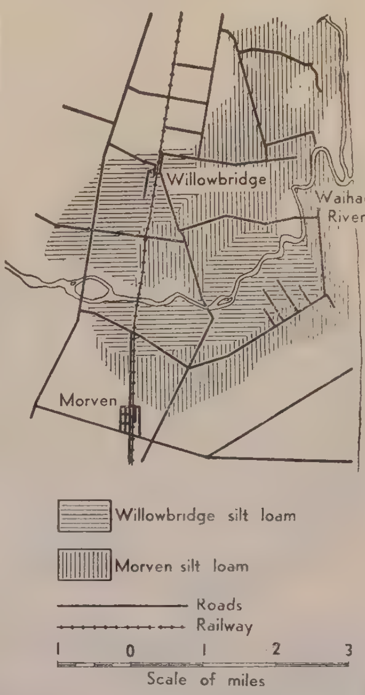
Soil Types

Though climate influences the location of potato growing areas, soil type is also important. The potato is fairly adaptable to varied soil conditions, but its successful culture generally calls for deep, naturally fertile, friable, free-draining soils of medium texture. Main-crop varieties grown on a commercial scale seldom yield satisfactorily either on light soils (especially in low-rainfall areas) or on heavy, slow-draining clays. Heavy, cold clays and wet soils generally are particularly unsuitable for commercial production, because they prevent early planting and optimum growth and hamper soil cultivations (including the frequent inter-row cultivations necessary to successful cropping) and harvesting.

Commercial growers therefore avoid the large areas of light, often shingly, soil types, the cold clay downs country, and the less extensive though well-defined areas of gley or meadow soil types (with high water-tables) that exist throughout the arable-farm area of Canterbury. Potato growing is confined mainly to medium and medium-heavy silt and sandy loams (recent alluvials) and, to a less extent, to young to immature soils of both alluvial and loess (windborne) origin. It extends on to some of the lighter silt loams, though they are prone to droughts, and on to the meadow and pan soils where drainage is satisfactory.

Though potatoes are grown on all of the soil types listed in Table 3, these soils are not all equally suitable for commercial production. Templeton silt loam, a very widely distributed type occurring along most river systems, is most frequently favoured and potatoes are grown on it in all regions and districts in which it occurs. The Waimakariri sandy loams, also widely distributed, are also much favoured. Paparua sandy loam and Barrhill fine sandy loam, which are somewhat akin to Templeton silt loam, are often used in the Christchurch and Mid- and North Canterbury regions, and a related soil type, Morven silt loam, is one of the main potato growing soils of South Canterbury.

SOIL TYPES WHICH GIVE HIGH POTATO YIELDS



(The type name of a soil does not mean that the particular soil type is found only in the area to which the name applies. For instance, Templeton silt loam is found not only near Templeton but in many parts of Canterbury. Soil names are taken from localities where the soil type was first identified or where it is extensive.)

Soil types of the meadow, organic, and pan groups are used to some extent where satisfactory drainage has been achieved. Meadow and organic soils are extensively used for dairying and market gardening (including potato growing) in the Marshland and Kaiapoi districts. Of the pan soils, Timaru silt loam on the clay down country is used to a limited extent near Timaru and Otaio, and drained areas of Claremont silt loam are employed in several Waimate areas.

Pukeuri silt loam, which occurs fairly extensively in the Morven district, is not very intensively cropped with potatoes, though it is quite suitable where drainage is satisfactory.

The lighter, rather droughty silt loams such as the Chertsey, Lyndhurst, and Hatfield types are used to some extent in Mid-Canterbury.

It is not possible to show on a small-scale map the location of all the soil types on which potatoes are grown, but the map above of the Willowbridge-Morven district in South Canterbury shows the location of the soil types Willowbridge silt loam and Morven silt loam, which are among the highest potato-yielding soils in Canterbury.

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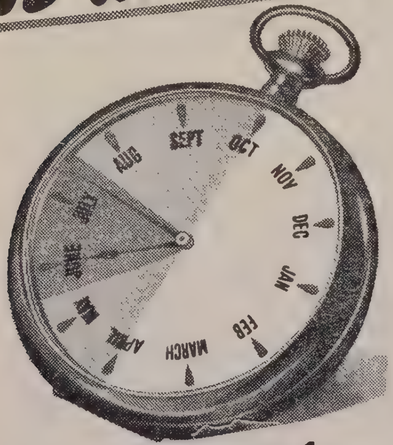

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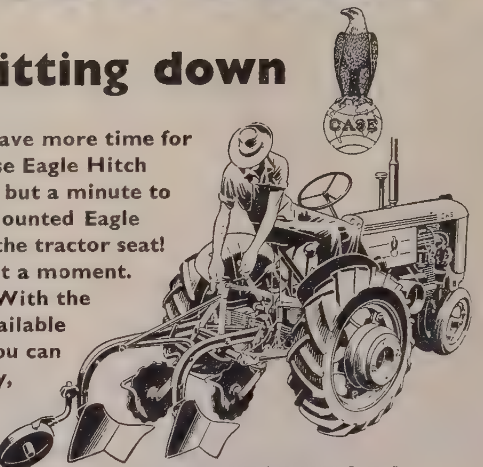

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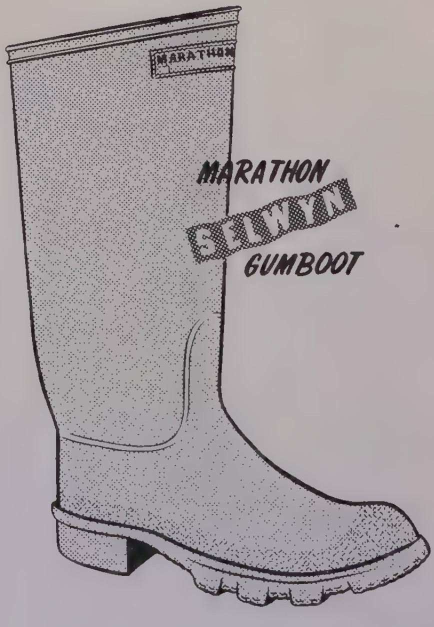

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A crop of Arran Chief potatoes near Studholme, South Canterbury. This is the main variety grown in this area.

Commercial Production

Commercial production of main-crop potatoes in Canterbury may be a feature or merely a sideline of arable or mixed farming. At least 75 per cent. of commercial production comes from arable and mixed farms where growing is conducted by the occupier of the land. The balance is produced either by market gardeners or by specialist growers who rent arable land from the occupiers or crop it on a share-crop basis. The growers provide all the machinery to handle the crop. This practice is commoner in parts of the South Canterbury district than elsewhere.

TABLE 3—POTATO GROWING SOIL TYPES IN CANTERBURY AND SOME OF THEIR MAIN CHARACTERISTICS

Classification	Soil type	Parent material (and class)	Topography	Drainage
I. Soils of the Downs A. With sub-humid climate	Oamaru clay loam	Lime marl and loess (heavy)	Rolling	Variable
	Timaru silt loam	Fine loess (medium-heavy)	Flat to rolling	Good surface, but pan
B. With sub-humid to humid climate	Claremont silt loam	Fine and coarse loess (medium)	Flat to rolling	Surface good on slopes
2 Soils of the Downs Margin (with sub-humid to humid climate)	Pukeuri silt loam	Calcareous alluvium (medium)	Flat to undulating	Variable
3. Soils of the Plains A. With sub-humid climate: Soils of the fans and high terraces	Hatfield silt loam	Aeolian (light-medium)	Flat	Free
	Chertsey silt loam	Aeolian (light-medium)	Flat	Free and droughty
	Barrhill fine sandy loam	Aeolian (medium)	Flat	Free and droughty
Soils of the fan margins and low terraces	Paparua sandy loam	Alluvium (light-medium)	Flat	Free
	Templeton silt loam	Alluvium (medium)	Flat	Retentive
	Wakanui silt loam	Alluvium (heavy)	Flat	Fair
	Temuka silt loam	Alluvium (heavy)	Flat and low-lying flat	Wet
Soils of the low-lands fringe	Willowbridge silt loam	Alluvium (heavy)		Optimum
	Morven silt loam	Alluvium (heavy)	Flat	Impeded
	Waimakariri silt loam	Alluvium (medium)	Flat	Retentive
	Waimakariri sandy loam	Alluvium (light-medium)	Flat to undulating	Free and droughty
	Kaiapoi silt loam	Alluvium (heavy)	Flat	Fair
	Taitapu silt loam	Alluvium (heavy)	Flat	Wet
	Waimairi peaty loam	Peaty alluvium	Low lying with depressions	Variable
B. With humid climate Soils of the fans and high terraces	Lyndhurst silt loam	Aeolian and alluvium (light-medium)	Flat	Free and droughty

Potatoes are included in crops grown by market gardeners in districts close to centres of population, such as Marshland and Yaldhurst. A large proportion of the Canterbury potato acreage is grown under contract through mercantile firms to the Potato Board, and in the Christchurch region in particular seed-producing areas of varieties sought by home gardeners are grown under contract to firms specialising in this trade.

Some districts and growers concentrate on the production of table-grade lines and seed production is of only secondary importance. With others seed production is the main consideration. Table-grade production occurs mainly on the more fertile soil types near the coast and seed production tends naturally toward inland districts where soils and climates are more favourable for this purpose.

In the North Canterbury and Christchurch regions such districts as Oxford, Sheffield, Annat, Springfield, Coalgate, and Hororata are recognised seed-producing areas and table lines are produced mainly in the Kaiapoi-Clarkeville, Marshland - Yaldhurst, Taitapu, and Leeston-Southbridge districts. Many Mid-Canterbury growers also concentrate mainly on seed production.

In South Canterbury the emphasis is more generally on production of potatoes for consumption, though the areas on the lighter land and at higher elevations also contribute to the seed supply.

The list of growers who contracted with the Potato Board in 1950-51 contains the names of 877 growers in the 14 most important potato-growing counties of Canterbury, made up of 102 in North Canterbury, 425 in the Christchurch region, 69 in Mid-Canterbury, and 281 in South Canterbury. The area grown by any one grower in most instances ranged between 5 and 15 acres; 20 per cent. of

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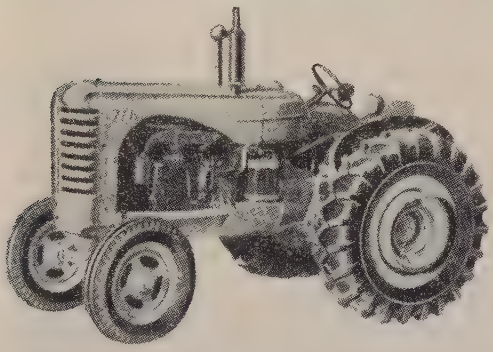

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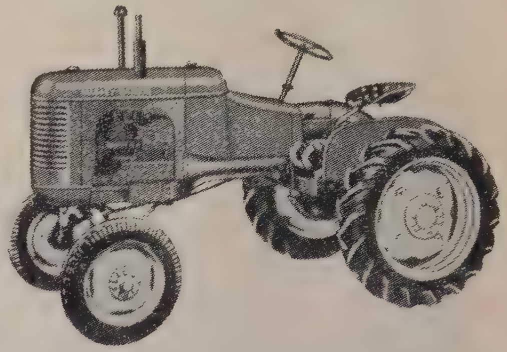

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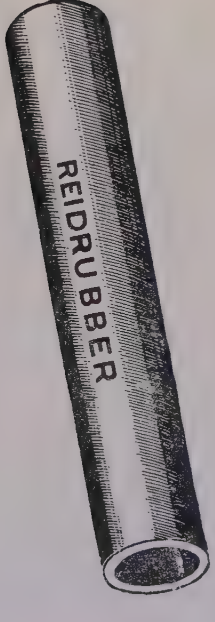

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Potato crop in the Annat district, which produces some of the best lines of seed potatoes. The land shown lies at about 1000ft. above sea level and the hills in the background are part of the downlands which rise to the mountainous country.

growers had less than 5 acres, 75 per cent. planted areas of less than 15 acres, and 85 per cent. less than 20 acres.

Varieties

The suitability of any variety of potato for main-crop production is determined by the possession of certain attributes chiefly related to consistently high yields of good-quality table-grade tubers under either a wide range or a particular combination of soil types and climate. The ideal variety would be one producing a high proportion of round or short oval, evenly shaped tubers of good size, but not too large or subject to second growth, with shallow eyes and a firm, smooth skin that was not damaged unduly by handling. The flesh of the ideal tuber would be white and firm with an acceptable flavour. Tubers should be capable of being stored for at least 4 months without deteriorating seriously.

Additional desirable characteristics include immunity from, or at least resistance to, attack by one or more of the various virus, bacterial, and fungous diseases which commonly attack potatoes. The haulms should have a reasonably tall, dense, and upright type of growth remaining erect in the early stages to facilitate suppression of weed growth and with, if possible, some resistance to frost. Also an advantage is the habit of producing tubers close to the plant and not at the ends of long stolons.

It is too much to expect that any one variety would measure up to these standards, but it is fortunate that plant breeders have raised a range of varieties one or another of which can be chosen to meet most of the trade requirements and the varying local growing conditions.

Aucklander Short Top

The variety that comes nearest to the ideal for a main-crop variety under Canterbury and, in fact, under New Zealand conditions is Aucklander Short Top, which originated as a selection from the once well-known English variety Suttons Supreme. Soon after its introduction in Canterbury in 1910 Aucklander Short Top gained and subsequently maintained its popularity for main-crop production throughout the country and is today the most widely grown variety in New Zealand. As a commercial variety it is not without shortcomings. Its tubers are rather thin skinned, fairly easily damaged, and subject to dry rot infection and frost and storage damage. When grown in heavy soils the tubers are inclined to become rough and knobbly. The variety is susceptible to leaf roll virus and also carries in all plants in a masked form two members of the mosaic group of viruses (viruses X and Y), one of which (virus Y) can be transmitted by aphides to neighbouring crops of other varieties. Its keeping quality, though good, is not as good as that of some others, notably Dakota and Arran Consul. It can be outyielded by most other commercial main-crop varieties, especially Arran Chief, when these are grown under conditions favourable to optimum growth and high yields per acre.

However, Aucklander Short Top yields consistently under a wide range of soil conditions and its evenly shaped, shallow-eyed, smooth-skinned, firm, and white-fleshed tubers, which are of good cooking and eating quality, make it almost universally popular with growers and consumers.

The variety does not produce a very strong top growth and though not free from attack by blight, it is not as susceptible as a number of other commercial varieties.

Aucklander Short Top is an early main cropper and is grown as the principal variety throughout most Canterbury potato growing districts. Districts where other varieties are preferred include Leeston-Southbridge and Springs (Dakota and Arran Banner), Greenstreet (Dakota), and a number of South Canterbury districts where Arran Chief is more popular.

Dakota

The red-skinned Dakota is also widely grown in Canterbury, especially in coastal districts from the Rangitata River northward. It is not extensively grown in South Canterbury, where Arran Chief and Aucklander Short Top predominate. Dakota crops best on sandy soils and, being a tall and vigorous grower, is also favoured in naturally weedy ground. The tubers are large, somewhat uneven and rough in shape with very deep eyes, but the firm, white flesh is of good flavour and excellent keeping quality. Under suitable soil and climatic conditions it is a heavy yielder and a hardy, late-crop variety. It is the only coloured-skinned variety favoured by the trade. Dakota is fairly subject to damage by blight and is also susceptible to leaf roll and mosaic diseases. All plants of the variety carry mosaic virus X in a masked form, and when infection with virus Y occurs a very severe form of mosaic disease results.

Arran Chief

Arran Chief is grown fairly extensively on the medium-heavy to heavy potato land in South Canterbury. It produces high yields of good quality table potatoes on the heavier Willowbridge, Morven, and Temuka silt loams in the Studholme-Willowbridge, Morven, Makikihi, and Redcliffs districts, where it is the favoured variety. Arran Chief is also grown extensively in the Clandeboye - Belfield, Temuka - Winchester, and Seadown-Kerrytown districts, but is not commonly found north of the Rangitata.

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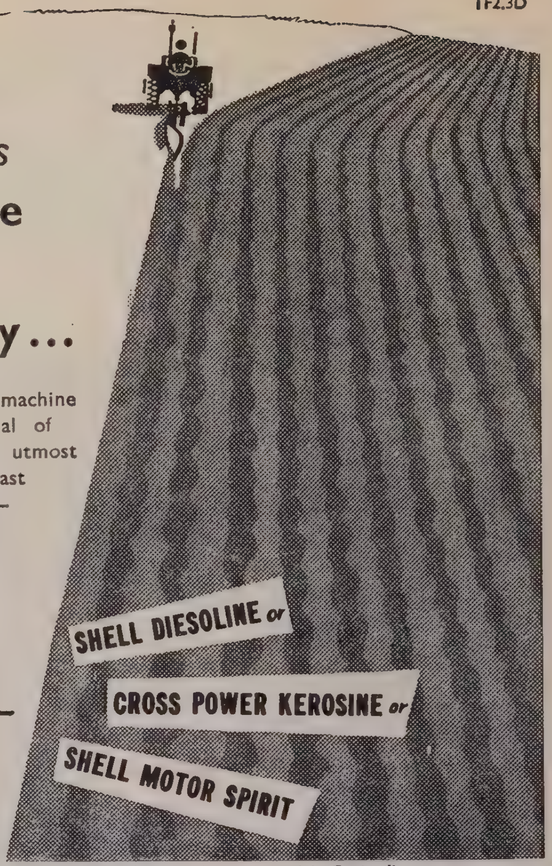

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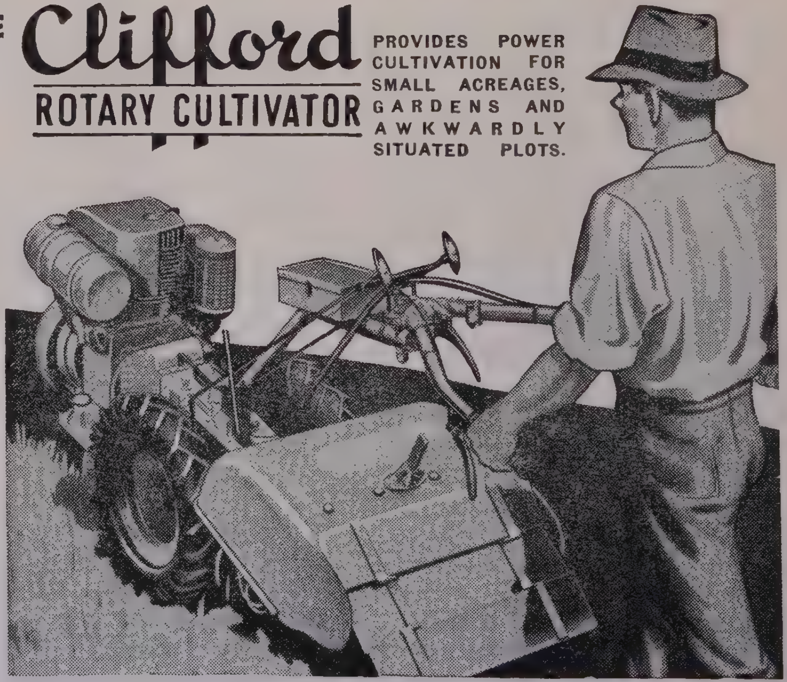

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Main-crop potatoes in Canterbury are harvested by mechanical diggers. Left—The single-row, apron-elevator, power-driven digger is the most commonly used machine. Right—Rear of a similar type of single-row digger.

The tubers are well shaped, shallow-eyed, firm-skinned, and of satisfactory flavour and keeping quality. This variety is susceptible to blight and also to mosaic and leaf roll viruses. It is a main-crop variety intermediate in maturity between Aucklander Short Top and Dakota.

Inverness Favourite

Inverness Favourite finds limited favour, mainly in South Canterbury for main-crop production on medium to heavy, well-drained soils, and is better suited to the heavier land. It is not nearly so adaptable to variations in soils and climates as other preferred varieties. In light soils and especially in dry seasons Inverness Favourite produces a high proportion of small tubers. It is fairly susceptible to blight and to both leaf roll and mosaic. Inverness Favourite matures fairly late.

King Edward

A long-established, partially coloured (white splashed with pink) variety, King Edward still finds some favour with South Canterbury growers, especially in the Clandeboye-Belfield and Temuka-Winchester districts. It is also a fairly popular home garden variety and commercial crops are often intended primarily for seed production. Tubers are of good shape and quality, but the variety is susceptible to blight and is severely affected by leaf roll and mosaic. It is an early main cropper.

Arran Banner

Arran Banner is grown extensively north of the Ashburton River. Though similar in maturity to Aucklander Short Top, Arran Banner produces its tubers earlier in the growing period. As a result the variety is frequently grown with a view to early market production or for early main-crop digging before the harvesting of Aucklander Short Top. Crops are also grown for seed production to supply North Island commercial and home garden needs.

Arran Banner is a vigorous grower which does best in light soils, the tubers tending to become gross and hollow hearted in heavy, high-fertility soils. The tubers are large, deep-eyed, firm-fleshed when mature, and handle reasonably well when dug immaturely for early markets.

Arran Banner is susceptible to attack by blight and also to infection with virus diseases.

Miscellaneous

A number of other varieties is grown, particularly in the Christchurch, North Canterbury, and Mid-Canterbury districts, often for seed production rather than for table use. These include both early and main-crop varieties such as Epicure, Aucklander Tall Top, and Iron Duke, the comparatively recently introduced American varieties such as Katahdin, Chippewa, and Sebago, and some New Zealand-bred varieties such as Glen Ilam and Ilam Hardy. The area in these miscellaneous varieties is generally very small.

Seed Supplies

Canterbury produces most of its own seed requirements and also supplies much of the seed required by North Island and some other South Island potato growing areas, including home garden requirements.

The bulk of the seed produced for local use and for dispatch to other areas is certified under the Potato Seed Certification Scheme conducted by the Department of Agriculture. Before the inception of the certification scheme one variety could often be found under two or more names, but in recent years it has been unusual to find varieties wrongly named. Under certification there has been a tendency for fewer varieties to be grown, though the demand for seed for home gardens has caused the retention of several varieties which otherwise would not be grown commercially.

Canterbury districts are not all self-supporting in seed potatoes. There is a fairly marked division into districts producing mainly table-grade lines and those where seed production is the more important aspect of potato growing. Generally the inland districts such as Sheffield, Springfield, Coalgate, Hororata, and Oxford are recognised seed-producing areas, and Marshland-Yaldhurst, Kaiapoi-Clarkeville, Taitapu, Leeston-Southbridge, Clandeboye-Belfield, and Willowbridge-Studholme concentrate mainly on table grades with seed production a secondary consideration.

The general tendency is for growers in coastal districts to procure fresh seed either annually or biennially from the recognised seed-producing areas. Sometimes a grower purchases sufficient Certified Mother seed to plant a seed-production area. Seed from this area is then used for his own main-crop plantings in the following year and any seed thus produced is subsequently sold.

In normal years there is a tendency for seed grown in North Canterbury, Christchurch, and Mid-Canterbury districts to be purchased by South Canterbury growers.

Waimate and other South Canterbury districts obtain fresh supplies of Arran Chief seed from Southland growers; otherwise there is little movement of seed into Canterbury.

In relatively aphis-free areas at the higher altitudes some growers have held their lines successfully since the inception of certification, and most of the Canterbury acreage is planted with Certified seed.

Seed Storage and Conditioning

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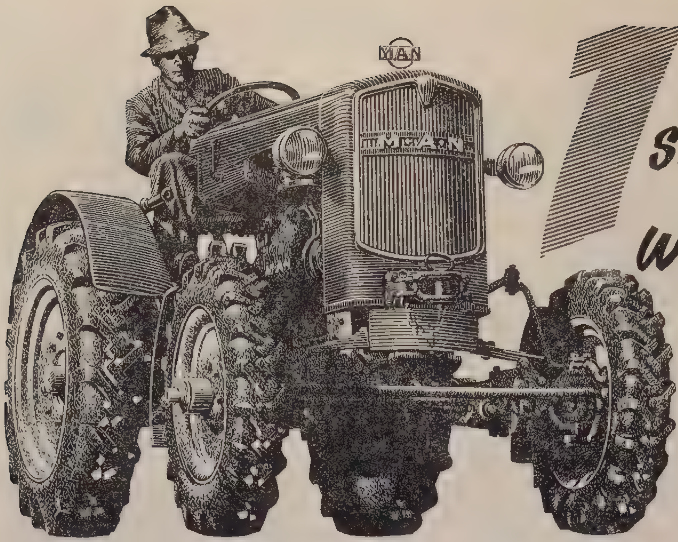

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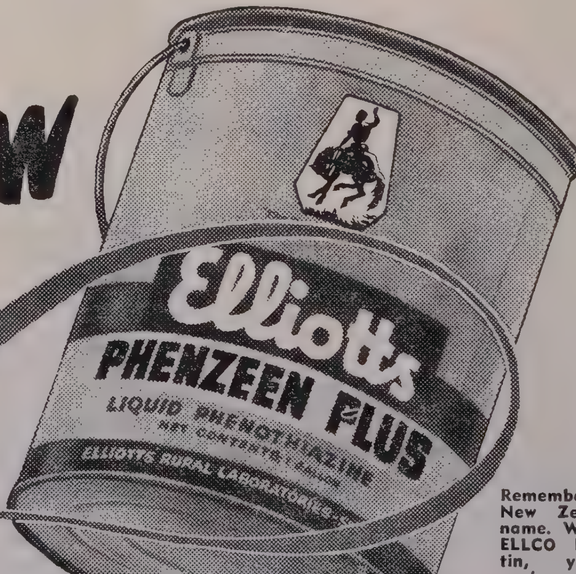

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Loading potatoes in the field with a mechanical loader. In the main potato growing areas handling of the crop is largely mechanised.

requirements or for subsequent disposal. Seed potatoes may be stored on gratings in sheds if such are available, as exposure to light does not harm them. They are either spread out thinly or left in the sacks, which are spaced to allow the freest circulation of air among them.

The main risks involved in storage arise from pitting lines that have been affected by blight or have been damaged by frost or digger or have received other mechanical damage that encourages the development of dry rot. In wet harvesting seasons the pitting of wet, mud-coated tubers is also likely to cause serious deterioration in storage, and in inadequately covered clamps tubers may be affected by frost. Excessive heating due to improper ventilation of clamps or stacks may also cause collapse of tubers and result in considerable loss.

Two or 3 weeks before planting, the sacks of seed are carted out into the planted field and distributed along the headlands, where the tubers green up and harden.

Rogueing of Seed Areas

As the spread of virus diseases and multiplication of foreign or off type plants can cause rapid deterioration in the cropping power and purity of seed lines, careful rogueing of crops is necessary to ensure high-quality seed. This practice is confined to crops in those portions of the potato cropping area where seed production is the main consideration.

To be really effective rogueing should begin as soon as diseased plants show up in the field and should be repeated at intervals until the tops die down. Early rogueing permits the removal of virus-infected plants while they are still small and perhaps before any transmission to other plants has taken place. Subsequent rogueings enable plants of foreign varieties to be detected more easily and diseased plants which have not shown up earlier to be removed. Late in the season plants affected by wilt disease, bolter plants (vigorous, late-maturing), and plants of other varieties of similar foliage but different maturity are more easily detected and removed. Most growers give only one (often late) rogueing, as other seasonal operations occupy their time round about the New Year. Such growers would be well advised to carry out a rogueing of their crops before the harvest rush.

The variety Northern Star is the most frequently occurring foreign variety in crops of Aucklander Short Top, Arran Chief, and Arran Banner. Arran Banner sometimes contains a percentage of bolter types that need elimination.

At one time the older varieties Leader and Scotia were prevalent impurities in Dakotas, but they have now been almost eliminated. A low-growing rogue, possibly Early Ohio, still appears in some lines of Dakota.

When a crop is rogued every plant is carefully scrutinised and obviously virus-infected plants or plants of weak growth or foreign variety are removed with any tubers they may have produced.

Potatoes in the Rotation

Though potatoes may be included satisfactorily at any stage in a normal crop rotation, the crop's attribute as a breaking in and cleaning crop preparatory to the sowing of cereals favours its inclusion as the first crop in the rotation. Because potatoes require deep tilth and frequent inter-row cultivations, they are an excellent breaking in and cleaning crop on virgin country or old grassland. Hence under arable and mixed farming most potato crops follow grass and are themselves followed by winter wheat, or, if late harvested, by spring-sown barley. A typical rotation would be: Grass, potatoes, wheat, greenfeed, fallow, new grass.

Occasionally potatoes follow winter fallow after rape or are preceded by turnips or swedes. On some of the heavier soil types potatoes may be preceded by wheat in an attempt to avoid excessive common scab (*Actinomyces scabies*) infection, which may prove prevalent when potatoes are planted after ploughing out of grass. Potatoes also follow wheat on many farms where the potato acreage is small and the crop occupies only part of a paddock.

Potatoes are seldom grown for successive seasons in the same ground except in market gardens or in a national emergency. When grown in conjunction with market garden crops potatoes have no fixed position in the rotation.

A survey of 107 potato growers in the Christchurch region showed that 73 (68 per cent.) grew potatoes following grass and 25 (23 per cent.) had potatoes as the second crop in the rotation.

Preparatory Cultivation

As most potato crops follow grass, cultivation practices in preparing the land for the crop do not differ much. The usual practice is to begin with a skim ploughing or hustling of the old turf to a depth of 2 to 3in. in autumn (February to March). The land then lies in the furrow until early May, when one or two grubbings and a harrowing may be given to hasten, if necessary, disintegration of the old turf. The area is deep ploughed (7 to 8in.) in early winter (May to June) and winter fallowed.

If twitch is troublesome, further hustling is done whenever soil and weather conditions permit and the twitch roots are gathered up and burnt. Otherwise the land remains in the furrow until September, when it is given a hustling or two followed by harrowing and rolling preparatory to planting. Rolling is not always necessary where the crop is to be planted mechanically, but it is advisable where the land is to be opened up with a ridging plough and the crop planted by hand.

The grass area is sometimes shallow ploughed in late autumn or early winter, disced or grubbed and harrowed in early spring, and deep ploughed before planting. Winter-fallowed areas out of old browntop turf are also sometimes deep ploughed again in spring. Reploughing in spring may be necessary after wet winters. When potatoes follow wheat the stubble is generally burnt and the area deep ploughed in late autumn. If a good burn is not obtainable owing to wet weather or heavy infestation of green weeds, the stubble may be grazed until June or July and then deep ploughed. Where straw is baled and the stubble is short burning may be omitted, the short stubble being ploughed in during late autumn. In September, after winter fallowing, the land is worked down by discing and/or grubbing and harrowing in readiness for planting.

After a rape crop has been taken the ground is deep ploughed in May or June, winter fallowed, and top worked in September onward until planting.

After swedes the ground is spring ploughed (August or September) and subsequently top worked with discs and/or grubbed and harrowed.

Irrespective of the method of preparatory cultivation adopted, best results are obtained by early, deep, and thorough working of the soil. A fine tilth is not essential for potatoes and may even be disadvantageous if the season is wet and the soil is inclined to set and cake. However, deep cultivation and the mellowing effects of winter fallowing are essential for optimum production.

Planting

Commercial planting of main-crop varieties normally extends over 6 to 8 weeks from late September to mid-November, most areas being planted in October. Practices in different districts vary slightly, largely according to the degree of risk of late frosts. Crops on the lighter soil types are generally planted early and those on heavier soils later. In a late season plantings continue throughout November.

Most commercial areas are planted mechanically with 1-, 2- and occasionally 4-row planters. Some small areas on both farms and market gardens are hand planted as are crops—usually of an early variety—on comparatively steep hill slopes, the rows being opened up with a ridging plough and the planted sets and hand-distributed fertiliser covered by splitting back the ridges.

Rows are 28 to 31in. apart and sets spaced at 12 to 18in. in the rows at a depth of from 3 to 6in. The most popular size of seed is 2 to 4oz. grade and such seed is usually spaced at 15 to 16in. in the row at a depth of 4 to 5in. The quantity of seed required to plant an acre will vary according to row spacing, distance apart of sets in the rows, and the average size of seed used. An approximate estimate of requirements is obtained by allowing 7cwt. per acre for seed averaging 1oz., 14cwt. for 2oz. seed, and so on for larger grades.

Fertilisers

The standard manurial practice for main-crop varieties in Canterbury is to apply 3 to 4cwt. per acre of a 3 : 1 mixture of superphosphate (or its equivalent) and sulphate of ammonia. Variations from the standard include phosphatic fertiliser (superphosphate or its equivalent) only at 3cwt. per acre or the replacement of sulphate of ammonia by blood and bone. On some of the more fertile sandy loam soils where high yields are obtainable the proportion of nitrogenous fertiliser in the mixture is reduced and heavier applications of fertiliser given by applying 5 to 6cwt. per acre of a mixture containing 5 parts of phosphate to 1 of sulphate of ammonia.

The fertiliser is applied along the rows at the time of planting. In mechanical planting it is distributed from the manure box of the planter, which allows the rate of application to be varied according to requirements. Where hand planting is practised the fertiliser is distributed by hand along the bottoms of the rows in a band 3 to 4in. wide. Applying the fertiliser along the rows with the seed at planting gives better results than prior or subsequent broadcast applications.

Inter-cultivation

When the crop is mechanically planted the area is left in a series of low, moulded rows. Subsequent working is done to control weeds and to further mould up the friable earth around the growing plants to allow full coverage and development of tubers.

If the soil has been pushed down by tractor and planter wheels, the inter-row spaces are best deep grubbed immediately after planting.

Some growers ridge up their crops immediately after planting, mainly to avoid possible waterlogging of the newly planted tubers if wet weather prevails shortly after planting. Many growers leave the crop in the low ridges left by the planter and after about 10 to 14 days, or even after the shoots have emerged, harrow the crop with tine harrows, preferably with worn points. This harrowing, made in the direction of the rows, breaks down the planter ridges and eradicates early-establishing weed seedlings.

Depending on the stage of growth of the crop and the amount of weed regeneration a further harrowing may be given 7 to 10 days later. Other growers prefer to follow this initial harrowing by one, and possibly two, deep inter-row grubbings at approximately 10-day intervals.

A few growers possess special, tractor-mounted, fine-toothed weeder-mulchers with independently sprung tine sections that automatically adjust themselves to uneven surfaces. These implements are used as an alternative to ordinary tine harrows in pre- and post-emergence weed control cultivations, and may even be used up to the stage when potato plants are 12in. high without unduly damaging established plants.

A half mould is given about a fortnight before the shaws are likely to cover the inter-row spaces and is followed up with a full mould a week to 10 days later. Once the shaws have covered the inter-row spaces inter-cultivation ceases, though some hand weeding of the rows may be done. With some upright-growing varieties, such as Arran Chief and Inverness Favourite, plants can be inter-cultivated to a late stage in development without being injured. With lax

Grading potatoes. The main grading of potatoes begins in June. Though some growers grade their potatoes out of the clamp, there are a number of contract graders who do grading on growers' properties.

and more spreading varieties, such as Arran Banner, inter-row cultivation cannot be prolonged.

When the final moulding is given the rows should be well earthed up; otherwise excessive greening of exposed tubers results. Further, tubers developed near the surface and not adequately covered by the mould are more susceptible to blight infection or attack by potato moth. A sharp-ridged mould gives tubers better protection from blight infection than a flat or depressed-top mould.

The amount and kind of inter-row cultivations given will be governed largely by the weather and the extent and rapidity of weed infestation. Pressure of other work will often reduce the number and alter the timing of cultivations given. Most growers use row-crop tractors and 2- or 3-row inter-cultivating equipment.

The following summarises the cultivation work normally carried out in preparing the ground (out of grass) for planting and in inter-cultivating the potato crop in commercial production areas:—

Pre-planting Cultivation

2 ploughings
1 discing (double cut)
4 grubbings with hustler
2 or 3 harrowings
1 rolling

Post-planting Cultivation

1 harrowing
3 inter-row cultivations
1 or 2 mouldings

[*Green and Hahn*

Potatoes are often stored in clamps in the field until they are graded. Sometimes potatoes are tipped on to prepared ground and stacked in a long heap which is covered with straw. A little soil is thrown over the straw to hold it in place and to give added protection.

Harvesting the Crop

Except in some of the smaller areas, the harvesting of main-crop potatoes in Canterbury is done by mechanical digging with tractor and occasionally horse-drawn machines. The single-row, apron-elevator, power-driven digger is the machine most employed, though some power-functioned double-row diggers are used.

In recent years a number of digger-baggers, some owned and operated by contractors, have been introduced. These machines dig and bag in one operation and usually as one sample. Digger-baggers have proved satisfactory in favourably dry harvesting seasons and with clean, free soil. They are probably used most extensively in the Waimate district.

The tractor-drawn but independently powered types of diggers, though more costly, have the advantage of greater flexibility in adjustment of apron speeds, which are not so easily regulated with models driven from the tractor power take-off. This is important, as potatoes are very prone to digger damage and subsequent loss by dry rot infection. Most of the damage arises from the agitated steel aprons of the digger, which, in addition to elevating the tubers from the ground, are intended to free them from the soil and top growth that lift with them. Consequently the degree of agitation, varying according to speed at which aprons are driven, has to be just sufficient to free the tubers without causing appreciable damage. When tubers are being lifted from light, free soil the speed must not be as high as that necessary for heavier or damp soils or where there is heavy weed growth. Undue damage can also be avoided by adjusting the depth of digging to ensure that sufficient soil is brought up on to the apron to cushion and prevent bruising of the tubers on the aprons. Rubber-covered apron bars may help to minimise damage, but are more likely to block unless diggers are working under excellent soil conditions. Rubber side flaps are sometimes used to prevent damage when tubers fall from the elevating apron on to the second (rear) apron of the machine.

Where strong weed growth would interfere with harvesting some growers adopt the practice of removing as much top growth as possible by quickly grazing the area with sheep. Provided the crop has been well moulded, this grazing causes little damage to the tubers. Removal of top growth by chemical spraying before digging is not commonly practised, though a few growers use a 10 to 12 per cent. solution of sodium chlorate or "Atlacide" for this purpose.

Tubers deposited on the ground by the standard-type digger are picked up by hand and bagged.

Tubers may be picked up as an "all-in" sample or as two main (table and seed) samples. Early crops are often picked up as two samples as also are main crops sold direct from the paddock, but in most districts the main-crop produce is bagged in the field as an all-in sample, pitted, and subsequently graded out of the pit or clamp. In the Christchurch region a number of growers still make a preliminary grading in the paddock.

Digging of main crops usually begins in late April, and during May the harvest is in full swing. Weather permitting, full advantage is taken of the school holidays to recruit student labour, as many growers rely on casual, seasonal labour for picking up and bagging. These employees are normally engaged on piece rates and are paid from about 1s. 6d. to 2s. 3d. per sack according to the condition and yield of the crop. Some growers who specialise in potato production maintain a fairly permanent gang for all their potato growing operations, but small growers can usually harvest without need of outside assistance.

On many farms main-crop potatoes, both table and seed, are stored for a period before grading and sale. Storage methods vary, but in the main they involve storing in clamps or pits in the field. Tubers are tipped out on to a prepared ground surface and stacked into a long heap, often confined between pit sides made with baled straw, each side being 2 bales high. This rectangular stack of tubers is topped off and covered with a thick layer of straw.

In South Canterbury tubers are usually clamped in sacks stacked vertically (on a straw or timber foundation) preferably as a single layer, but not exceeding two tiers, and topped off with bags laid horizontally. The clamp is then covered with straw.

The clamps are sited on dry ground and, when possible, under protection of trees and with provision for ventilation. Where natural drainage is not good a drain is excavated round the clamp to ensure adequate protection.

Grading

The main grading of potatoes from the pits begins in June and normally continues through to August or later. Many growers grade their own produce out of the clamp, but in most districts there are contract graders who undertake grading for the grower on his property. In the last few years several firms in the Christchurch area have established a grading service in their stores. This service is finding increased favour with Christchurch, Mid-Canterbury, and North Canterbury growers, for in many instances it relieves them of both storage and grading problems, the produce being picked up as one sample and dispatched direct from field to grading store.

Irrespective of the procedure adopted, there are certain recognised grades into which it is usual to grade potatoes. The usual grade for table potatoes is described as f.a.q., which generally includes lines with a small number of tubers less than 2in. in diameter and which are reasonably free from damage, earth, and tuber diseases. Good table grade comprises lines of better quality than f.a.q. Potatoes below f.a.q. grade are described as undergrade.

The grading of seed varies according to whether or not it is the produce of a crop provisionally certified under the scheme of certification conducted by the Department of Agriculture. Such seed is tagged as Certified if after grading it complies with the standards set for freedom from diseased or damaged tubers and tubers of other varieties, and is graded to size within certain specified limits, details of which are given to all growers of provisionally certified crops. For example, if the smallest of 16 tubers in any 100 average 2oz., the largest 16 must not exceed an average of 4.3oz.; if the smallest average 2.2oz., the largest must not exceed 4.5oz. As the average weight of tubers increases so does the difference in average weight between the smallest and the largest 16's. Seed from crops not provisionally certified is described as uncertified and is normally graded as f.a.q. seed (tubers between 2 and 4½oz. and of reasonable quality) or undergrade seed (lines not up to f.a.q. standard).

Marketing

Almost the whole of the Canterbury main-potato crop is sold to potato merchants, who in turn supply local markets or arrange for the forwarding of supplies to other parts of the South Island as required and to the North Island. Price orders for table and seed potatoes set out the prices payable to growers for their produce and describe in detail the variations in price according to grade, variety, and certification grouping.

In 1950 a Potato Board was established to ensure as far as possible an adequate supply of potatoes for local requirements. Most Canterbury growers enter into contracts with the board under which the grower delivers his crop to an authorised wholesaler for marketing and the board undertakes to compensate the grower for table potatoes unsold at the end of the season.

The board is composed of three representatives of the growers and of the merchants and one advisory member appointed by the Government. For its finance to meet working expenses and any liability incurred under its contracts with growers the board depends on a levy made on all table potatoes.

Yields

The average yield of Canterbury potato crops is approximately 7 tons per acre (table and seed). The average proportion of seed to table grade is comparatively high, normally 2 parts seed to 5 parts table. In dry seasons the ratio of seed to table may be more than 1 to 2. This high percentage of seed is due partly to the general soil conditions and climate throughout the potato-growing district of Canterbury, which are not conducive to large yields and a high proportion of large tubers. It is accentuated by the fact that, as Canterbury is the recognised potato seed-producing province of New Zealand, lines are often graded for seed to a higher maximum tuber size. Thus 5 and 6oz. tubers from some certified crops that would in other circumstances be graded into table lines find their way into lines intended for seed.

The various districts throughout Canterbury vary in their ability to produce high average yields. In some districts in a very favourable season yields of up to 20 tons per acre are not uncommon. Districts with normally high average yields include Kaiapoi-Clarkville, Marshland-Harewood, Leeston-Southbridge, Clandeboye-Belfield, and Willowbridge-Studholme. Variety differences also have a considerable bearing on crop and district averages. The average yields per acre expected from crops of the principal varieties grown in Canterbury in favourable growing seasons would be: Arran Chief 10 tons, Arran Banner and Dakota 7 to 8 tons, and Aucklander Short Top 6 to 7 tons.

Diseases and Pests

Compared with many other potato growing areas, especially those in the North Island, where the climate is more favourable to the onset and rapid spread of plant diseases and insect pests, the potato crop of Canterbury is damaged little by diseases and pests. The comparatively hot, dry, low-humidity weather normally prevailing throughout the late summer and autumn and the severity of the winter are mainly responsible for Canterbury's fortunate position.

Late blight seldom assumes serious proportions in commercial crops, though there have been severe attacks in a few years. Owing to the infrequent occurrence and low incidence of this disease, sprays are seldom necessary and are not widely used.

Virus Diseases

The most serious diseases of the growing period in coastal districts are caused by infection with one or more of the aphis-transmitted viruses which are responsible for the symptoms of leaf roll and mosaic diseases appearing in the foliage. Growth of infected plants is stunted or otherwise deformed, tuber size is reduced, and as infection spreads running-out or loss of cropping power of the line occurs. The viruses causing these diseases are carried over from season to season in tubers from diseased plants and are also transmitted from diseased to healthy plants during the growing season by aphides.

The increase in the proportion of diseased plants in a line is more rapid in areas of low altitude where there is a relatively high aphis population.

In some inland districts of Canterbury, chiefly in the foothills, the aphis population is very low and in these districts it is possible to maintain initially healthy lines in a virtually virus-free condition. It is here that most of the seed-producing lines are grown, any incidence of virus being controlled by thorough rogueing of seed-producing crops to eliminate diseased plants and their tubers.

Scab Diseases

Ordinary or common scab is fairly common in lines grown in highly fertile, organic soils or on land that has been heavily limed. This superficial disease affects the appearance of lines without reducing yields or affecting the eating quality of tubers.

Powdery scab, which can occur under somewhat similar circumstances to common scab, is seldom prevalent in Canterbury crops.

In recent years a disease thought to be black dot (*Colletotrichum atramentarium*) has appeared in crops of the Waimate district and has resulted in yield losses varying from 1 to 5 tons per acre. It appears to be most prevalent in crops on heavy soils and is apparently worse where potatoes are grown too frequently in the rotation.

Dry Rot

The most serious disease of stored tubers arises from dry rot caused by the fusarium group of soil fungi. Dry rot frequently develops among stored tubers that have been bruised and damaged during digging or subsequent handling. It is generally more prevalent in lines after a wet harvesting season and among the thin-skinned varieties such as Aucklander Short Top, Majestic (little grown in Canterbury), and Dakota. Wet rots, mostly of bacterial origin, often result as a secondary infection in lines affected by dry rot.

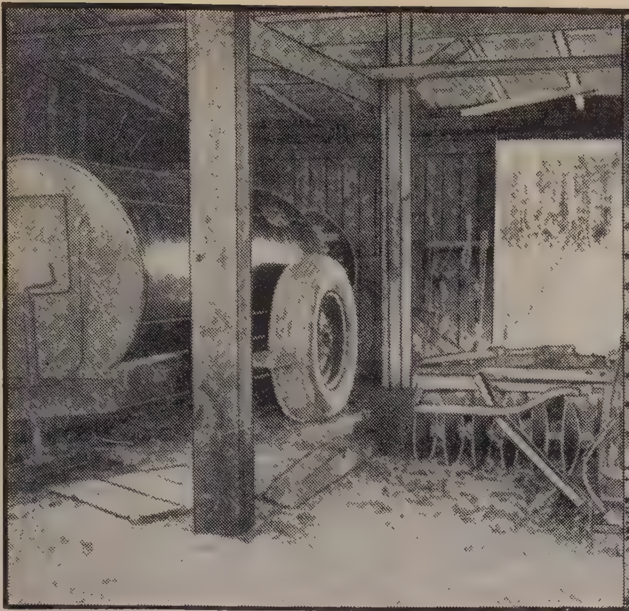
Dry rot infection is best avoided by digging only fully matured crops, by refraining where possible from harvesting from wet soil, by lifting the crop with the least possible damage to tubers, and by storing under dry, cool, well-ventilated conditions.

Canterbury crops are seldom seriously affected by insect pests. Eelworm and wireworm damage occurs occasionally in some districts and the potato moth, though it can cause serious damage at times, is seldom troublesome.

Needs and Prospects

To ensure adequate supplies for the Dominion's present population an annual potato area of approximately 22,000 acres is required and Canterbury normally sows half or a little more of this. In recent years the area has been between 9000 and 10,000 acres, the lowest for the past 30 years, and this decline can be attributed partly to economic factors, difficulties associated with scarcity of seasonal labour, and to some extent to unfavourable weather.

However, Canterbury's topography, climate, and soils make it the most suitable main-crop potato producing area in the Dominion, and as some of the present difficulties are overcome Canterbury potato growers will no doubt contribute their quota to the Dominion's requirements without in any way affecting their production of other commodities.



Care of Spray Equipment

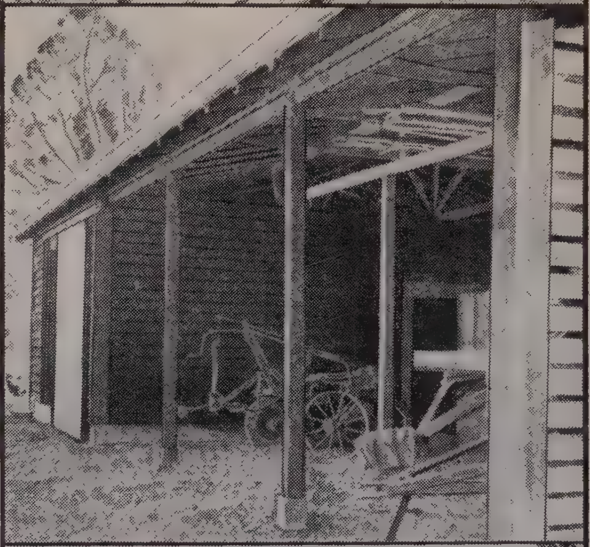
By I. L. BROWN, Horticultural Instructor, Department of Agriculture, Nelson

CONSIDERABLE capital expenditure is represented by orchard and market garden equipment and it is obviously economically sound to maintain it in the best condition. Failure to keep machinery such as spray outfits in good repair can cause many irritating and costly delays during spraying as well as rapid deterioration in value. Many implements, particularly portable spray pumps, are required to travel over fairly rough surfaces doing comparatively dirty work. The rougher the work the greater the need for constant care and adjustment.

MOST breakdowns and consequent delays can be prevented if the entire machine is regularly dismantled and examined either by the owner or a competent mechanic. In orchards and market gardens there is usually opportunity to carry out this work between the end of the harvest and the beginning of pruning or preparations for another crop. Repairs and maintenance should not be regarded as odd tasks to be done if there is no other important work to be done, but as essential work to enable worn and weak parts to be located and repaired or replaced before the demands of busy periods cause further wear and ultimate breakdown.

Care and maintenance of equipment include protection from weather when it is not in use as well as cleaning, oiling, greasing, adjustment and replacement of worn parts, and prevention of rust or corrosive action by water and chemicals. Good housing not only protects machinery from deterioration through exposure to all kinds of weather, but is also conducive to good maintenance. If satisfactory cover is provided, repairs and inspections can be carried out comfortably when wet weather prevents outside work. Equipment left outdoors whether covered with weatherproof tarpaulins or not is unlikely to receive attention until fine weather, by which time it is probably necessary to do other outside work and so the necessary repairs or adjustments do not receive attention.

The shelter provided does not need to be elaborate, but a well-built shed large enough to house all the equipment used on a property is desirable. If the building can be so sited that it is possible to drive in one side and out through another side, parking and picking up of equipment can be done with ease. Suitable sheds are illustrated. Implement sheds need not be floored other than with shingle or



ILLUSTRATIONS: Sheds suitable for housing spray outfits and other equipment.

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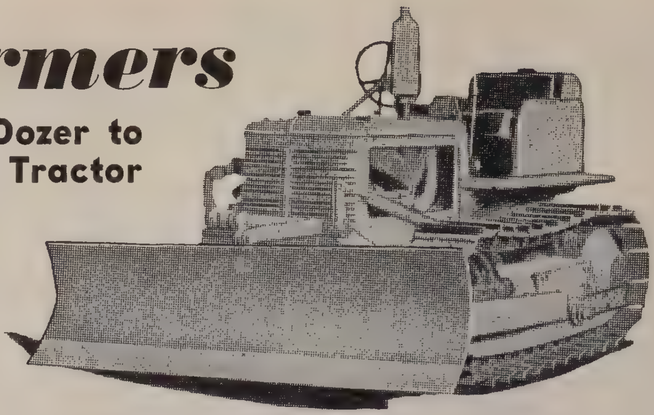

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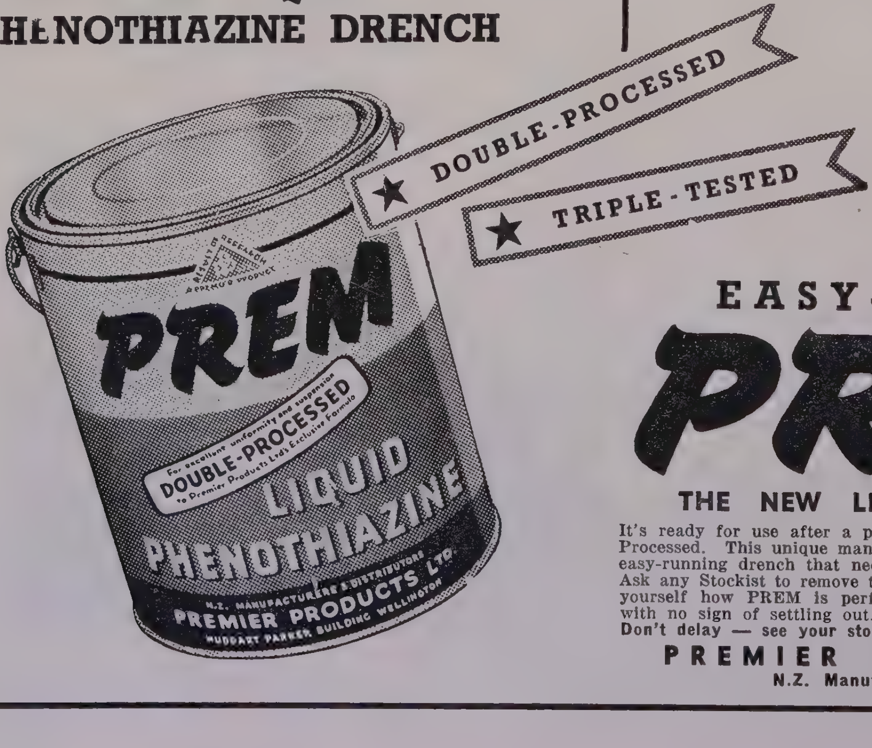
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gravel, but part of the floor space if paved with concrete or other suitable material, will be found most useful when carrying out repairs, especially if it is necessary to dismantle all or part of the machine.

Tools

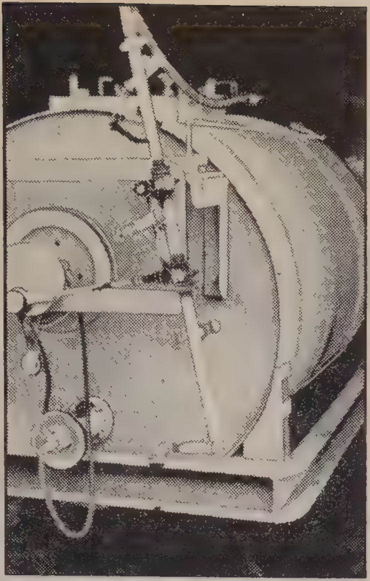
The implement shed is the most suitable place to store tools so that they can be located immediately they are required. Large and elaborate tool or work shops are not essential for good maintenance work. A few good tools used properly are capable of doing all that is required to most machinery used on orchards or market gardens. All repairs and adjustments except major ones should be possible with the following or similar tools: A pair of pliers, 14in. and 18in. pipe wrenches, a hacksaw and blades, 8in. screwdriver, vice grip, 10in. adjusting spanner, set of 6 ring spanners, and an oilcan. To this list should be added one or two grease guns if they have not already been provided with the machinery. Two grease guns will be found useful, as pumps should not be lubricated with an axle grease but with a water-pump grease. Pump greases are made to withstand the action of water and spray mixtures. Excessive wear to pump plungers and cylinder packing has been known to occur through failure to recognise this difference between types of lubricant.

This list is not large, but if a spray outfit is kept in good repair and if bolts, nuts, screws, and other parts that may require removal are not abused, the tools listed are capable of all that is required. When these tools are being used excessive force should not be used to move stubborn bolts or screws. The correct spanner should be used for the task in hand. Nozzle caps should be removed by hand or with a vice grip; pipes should be held and turned with a pipe wrench. Pipe wrenches should not be used on nuts and bolts. The range of sizes included in the set of ring spanners should enable all sizes of nuts to be fitted snugly and not be damaged by loose-fitting, large adjusting spanners. Spanners which do not exactly fit a nut or bolt head will round off the square surfaces and make future turning difficult. The life of tools and of all nuts, studs, bolts, and screws can be made indefinite if they are given a coat of grease or a graphite preparation during assembly. Corrosion and rust are thus prevented and ease of movement will be ensured when tools are used.

Cleaning Spray Outfits

It should be standard practice to clean out and wash down spray outfits thoroughly with clean water at the end of each day's spraying. Solutions or suspensions of spray materials left in vats or tanks and other pump parts can cause corrosion and leave troublesome sediment. Cleaning the spray pump should be done more thoroughly than merely by allowing spray mixtures to drain out. Tanks and pumps should be treated as follows:—

1. Flushed thoroughly with clean water.
2. The suction line should be allowed to suck air to allow the pump to discharge as much water as possible.
3. The plugs or valves at the bottom of suction strainers should be opened.



Mechanical spray boom, moving parts of which require lubrication.

4. All plugs in the overflow line should be removed.
5. Plugs at the side or end of the suction line or below the level of the pressure chamber should be removed.
6. The pressure controller should be drained.
7. If valves are fitted with drain plugs, these should be removed to allow the water to drain from the cages.
8. All strainers should be thoroughly cleansed of sediment.

If flushing and draining are being done preparatory to storage of equipment at the end of the season or if the pump is not to be used for some time, the packing adjustment screws fitted in the plunger cylinders of many pumps should be loosened to allow the packing to expand and thus remain resilient. It is also good practice if the pump is not to be dismantled immediately for overhaul or if it is to be overhauled later, to fill it with a light lubricating oil. This keeps packings soft and prevents rust and corrosion of internal parts. Hoses or other rubber parts deteriorate from contact with oil.

While the spray outfit is under cover between spraying seasons it should be dismantled and all parts cleaned and examined for wear, and repairs or renewal made where necessary. Where this has been the practice spray outfits have consistently given trouble-free operation throughout the busy periods and wear and tear have been reduced to a minimum. Spray outfit component parts such as the tank, chassis, and wheels should also receive attention. Cleaning both inside and out and treatment with anti-corrosive preparations will pay dividends.

Pneumatic tyres should not be neglected and while in use should be inflated to the correct pressure and checked regularly to ensure that it is maintained. All rubber parts including tyres should be kept free from oil and grease. When the outfit is stored at the end of the spraying season it is good practice to jack up or remove the wheels to relieve the tyres from the strain of standing under the weight of the outfit for several months. Removal of the wheels also affords an opportunity for checking wheel bearings and axles for wear and adjustment. True, free-running wheels reduce the effort required for traction.

Care during Operation

During working operations all moving parts should receive adequate and regular lubrication and be kept in good running order by adjustment.

Lubrication of most spray outfits entails attention to the following points which are usually stressed by all manufacturers:—

1. Lubricate plungers with a suitable grade of pump grease every hour while plungers are in use.
2. Lubricate agitator shaft bearings, yoke guides, and other moving bearings thoroughly every day.
3. Lubricate pressure controllers lightly according to manufacturer's recommendations every day.

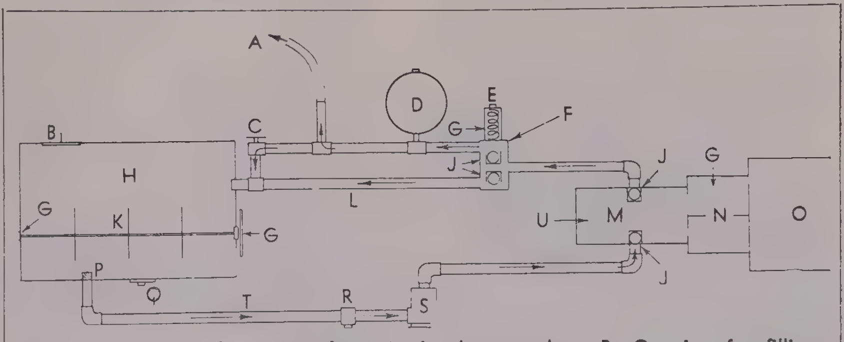
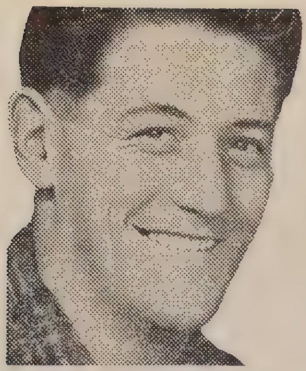


Diagram of parts of spray outfits. A—Lead to nozzles. B—Opening for filling. C—Pressure release (not on all pumps). D—Pressure chamber. E—Pressure controller. F—Discharge line. G—Points requiring lubrication. H—Spray vat or tank. J—Valves. K—Agitators. L—Overflow back to tank. M—Pressure end of pump. N—Gear for transferring power to pump. O—Power for driving pump from engine, motor, or tractor. P—Strainer sometimes placed at this end of suction line. Q—Drain cock or plug. R—Valve or stopcock. S—Sediment chamber or strainer. T—Suction line. U—Plungers in pumps not self-lubricating. Solution is drawn from tank through a strainer or to a strainer in the suction line, thence to the pump, which discharges by pressure or displacement to discharge line on which is the pressure or air chamber to cushion the discharge and give a steady flow at the nozzles.



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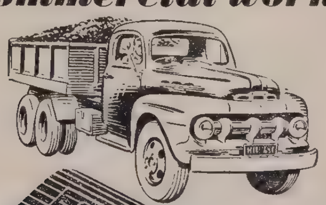

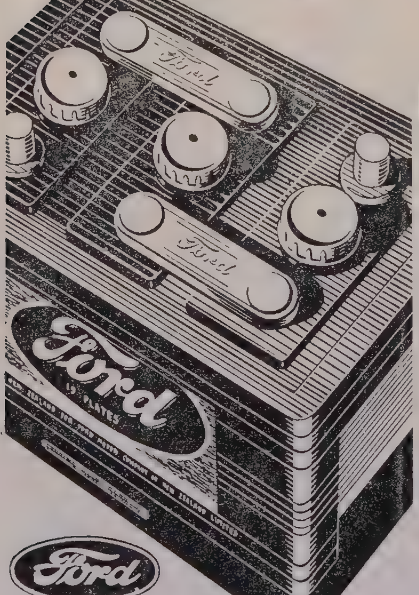

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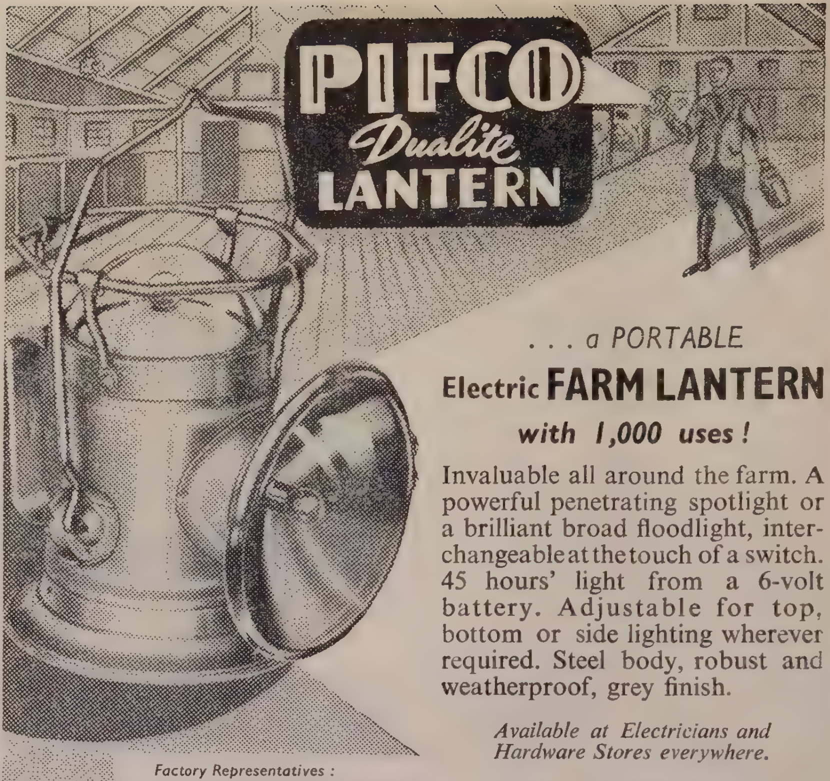

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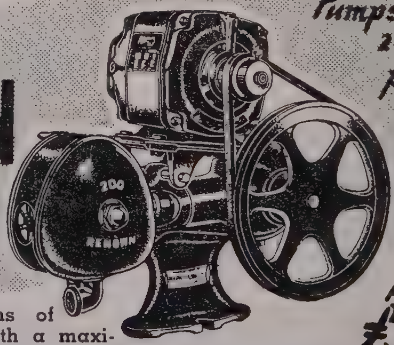

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4. Keep gear cases filled to the oil level set by the manufacturer. Drain and refill them periodically. This also applies to many of the modern pumps which are almost entirely self-lubricating.
5. Keep wheels, power take-offs, chain drives, and other power transmission gears lubricated as required.

Pressure Failure

Attention to lubrication together with regular inspection and overhaul should keep the spray outfit in good working order. However, during working the corrosive action of water and spray materials often causes wear or the failure of the pump to work efficiently. Failure of a pump to maintain an efficient pressure may be due to any of the following causes.

1. Incorrect adjustment of the pressure controller.
2. Badly worn balls or ball seats in the pump valves or pressure controller.
3. Grit or other foreign matter between the balls and seats of the valves in pump or pressure controller.
4. Sticking suction valves.
5. Sediment or wear of diaphragms in diaphragm types of pressure controllers.
6. Clogged strainers in the suction line.
7. Too large a discharge orifice in the discs at the nozzles. This is a more common fault than is often recognised.
8. Operating too many nozzles for the capacity of the pump.
9. Insufficient power or revolutions per minute being transferred to the pump from the motor. This can be caused by failure of the motor to produce the required horsepower.

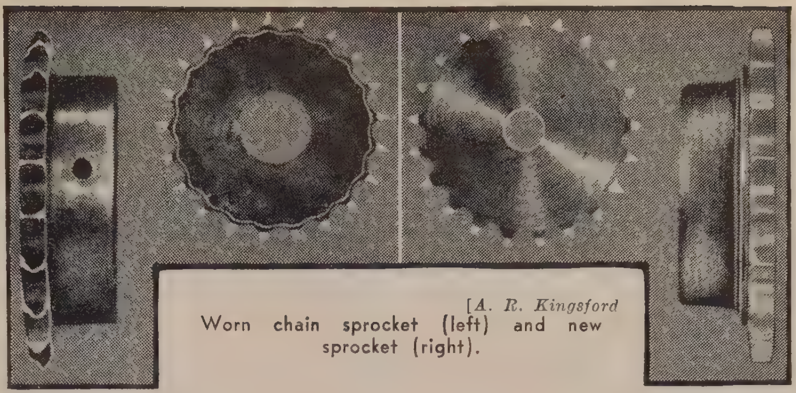
Failure of a pressure controller to maintain the required pressure is sometimes hard to detect. When trouble is experienced the controller should be dismantled and the valves, plungers, and plunger cylinder walls examined for faults.

Before adjustments are made to pressure controllers, however, the pump should be checked to make certain it is operating correctly in all other respects. For example, if pressure drops when the nozzles are turned on, it is probable that the discharge is excessive or that the pump valves are not functioning properly. It may even be that the overflow valve is allowing too much liquid to pass. If it is ascertained that the pump is working properly, the controller can then be adjusted. This should be done with the hoses turned off.

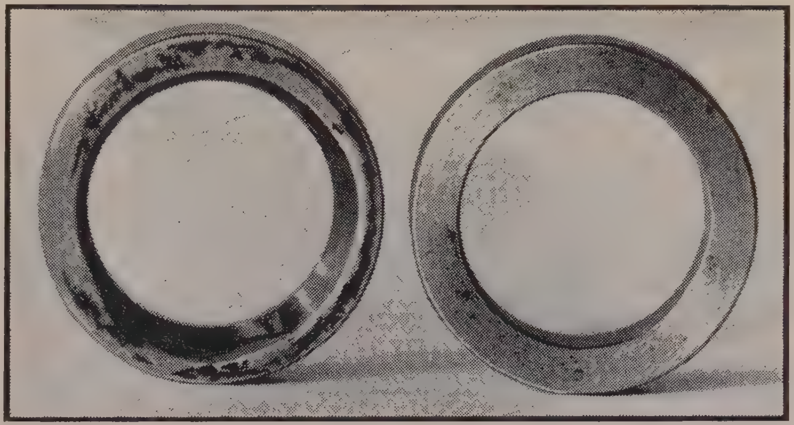
Failure of Pumps to Start

Should a pump fail to start pumping after storage or during working, the cause may be located at any of the following points.

1. Sticking of pressure valves.
2. Sticking of suction valves.
3. Grit or other foreign matter in the valves.
4. Air leak in the suction line or manifold.
5. Air leak through valve lifters if the pump is so fitted.
6. Air leak through gaskets beneath ball cages or at other points on the suction line.
7. Air lock in the pump.



[*A. R. Kingsford*
Worn chain sprocket (left) and new sprocket (right).



[*A. R. Kingsford*
Worn tapered roller cup (left) compared with new one (right).

To rectify the last fault the plug in the top of the discharge manifold or pressure cylinder should be removed and the pump operated until water is discharged through the plug hole. The plug should then be replaced.

Reassembly after Overhaul

When a spray outfit is reassembled after an overhaul or after running repairs care should be taken to see that all gaskets and gasket surfaces are clean and free from dirt and that all bolts, nuts, screws, studs, pipes, and hose connections are firm. Firm does not mean tightening them to the utmost limit with excessive force and leverage, but snug fitting on all surfaces and tight enough not to work loose. Excessive pressure exerted on the threads of nuts, bolts, studs, or screws will almost certainly cause damage or breakage. The handle of the appropriate spanner will give enough leverage.

When a pump is being assembled after plungers or pump cylinders have been repacked the packing can be compressed too tightly. When pump packings are being tightened by adjusting screws the screws should be taken up until they are just firm. They should then be relieved slightly by turning the screw back a part turn. Over-tightening will shorten the life of the packing and can cause excessive wear of the plunger. Pump plungers working in excessively tight packing will also make greater demands on power to drive them efficiently.

Stationary Outfits

Maintenance of a stationary spray outfit is similar in all respects to that required by portable outfits except that there are no wheels or chassis.

Housing is important and should be ample, weatherproof, and so constructed that maintenance and overhauls can be carried out without inconvenience. Cleanliness in a pump shed is also essential.

Stationary outfits are liable to develop the same faults during spraying operations as other pumps. Additional trouble can be caused, however, if the pipelines and taps are not kept in good order.

Pipelines, spray vats, and pumps should be kept clean by a thorough flushing after each spray and by periodic flushing with a 5 per cent. solution of hydrochloric acid or similar cleansing agent. After they are cleaned with acids pumps and pipes should be well flushed with clean water to remove all traces of the acids.

Loss of pressure in a stationary plant can, in addition to the causes listed for other pumps, be caused by sediment in the pipes and leaking pipes or taps. Stationary outfits require a chamber of larger capacity than other pumps and may fail to maintain an efficient working pressure if the pressure chamber is too small.

Oversowing of Poor Pastures on Peat

PASTURES on peat sown down with cheap seed mixtures and little fertiliser can be improved by being oversown with legumes. Red and white clovers increase not only the dry matter production of the pasture, but improve the palatability at the same time. Although very little nitrogen produced by the clovers is available for grasses in acid peat soils, more becomes available when the peat decomposes. In this article J. Adam, Research Officer, Rukuhia Soil Research Station, Department of Agriculture, Hamilton, describes the results of trials on peat conducted at Rukuhia and makes recommendations on methods of oversowing such pastures.

A. W. GREEN, formerly Manager of Ruakura Farm of Instruction, in his article "Development of Swamp Land at Ruakura" published in the "Journal" of January 1918 makes this interesting observation: "After the land has been well consolidated with stock, clover-seed surface-sown about the end of September will give excellent results. Sow 10 lb. red clover, 2 lb. alsike, 1 lb. white clover, and 1 lb. *Lotus major* per acre. Close from stock for at least one month after sowing. Sorrel-heads may appear at this season of the year, and it is advisable to run the mower over the field before the seed sets, thus preventing seeding."

The pasture to which the article refers had been sown down the previous autumn with 20lb. of Western Wolths ryegrass per acre. No Certified perennial ryegrass was available then.

Although high-producing species have been introduced, and farm mechanisation and fertiliser applications have been a great help to farmers since Green's article was written, there are still hundreds of acres of poor peat pastures in the Waikato which could be improved considerably without the expense of laying down a new pasture.

Trials at Rukuhia

The pasture used for a trial conducted by the Rukuhia Soil Research Station showed a dense mat of Yorkshire fog with a few isolated *Lotus* plants. The peat was very acid and 20ft. deep. A few rushes and manuka had to be cut by hand before the area was harrowed. On 19 September 1949 the seed and fertiliser were broadcast. One month after the oversowing a very promising take of young clover and ryegrass plants was showing, the great majority being where the turf had been removed by harrowing. Very few seeds had germinated in the Yorkshire fog. By the middle of December all plants had died owing to lack of moisture and to a less degree the competition of the fast-growing Yorkshire fog.

Because of this failure it was decided to repeat the trial with some modifications in the autumn of 1950 to ensure favourable moisture conditions and eliminate the competition of the Yorkshire fog.

The area was closely grazed and then harrowed crosswise to make sure that half the paddock was stripped of its dense Yorkshire fog mat. The loose Yorkshire fog was raked off the area.

Seed Combinations

The following seed combinations per acre were sown:—

1. 10lb. of perennial ryegrass, 5lb. of paspalum, and 3lb. of white clover.
2. 10lb. of perennial ryegrass and 3lb. of white clover.
3. 6lb. of white clover.
4. 3lb. of white clover.

The whole area was broadcast with 1 ton of lime per acre. One half received 2cwt. of serpentine superphosphate and 2cwt. of muriate of potash per acre, and the other half 2cwt. of serpentine superphosphate and 1cwt. of muriate of potash per acre. A handful of fertiliser, mostly lime, was scattered into each hollow where rushes had been cut out.

In the following spring many white clover plants had spread in all plots. The density of the sward in the area oversown with 6lb. of white clover per acre was no different from that sown with 3lb. The paddock was very low in available potash and the plots receiving 2cwt. of muriate of potash carried clover leaves slightly larger than those on the 1cwt. plots. Although some ryegrass had germinated, it did not develop much growth over the next 2 years.

Paspalum was not showing at all. In previous trials conducted on peat where paspalum was sown in a mixed pasture it appeared mainly in the low-fertility plots.

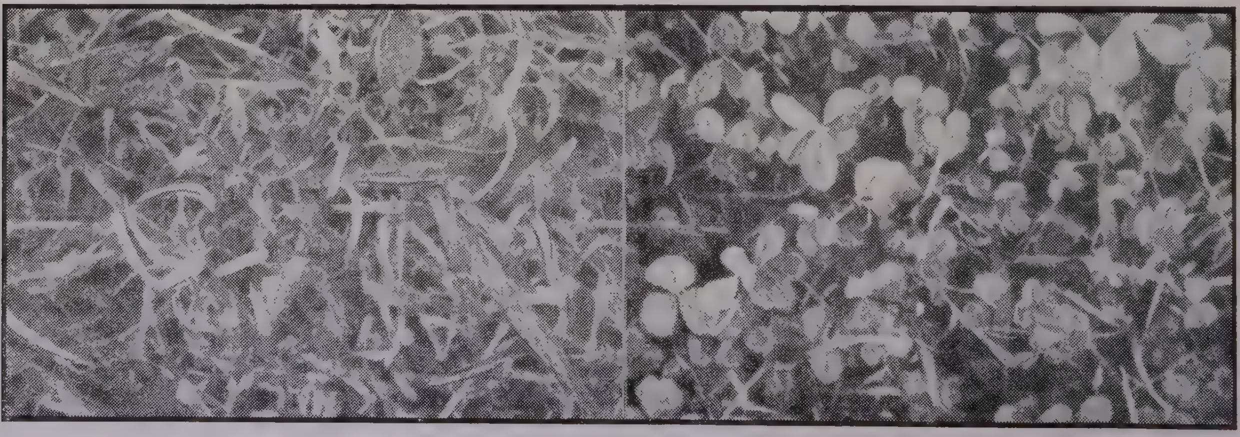
Treated patches where rushes had been cut out were covered by a dense clover sward which stayed green during the dry summer.

Recommended Procedure

In the light of these trials and various other observations, the following recommendations are made for autumn oversowing of poor pastures on acid peat soils:—

1. Graze pasture closely.
2. Harrow heavily to expose some bare ground and provide a seed-bed for germination.
3. Broadcast 2lb. of white clover and 1lb. of Montgomery red clover per acre. Apply 1 ton of ground limestone, at least 2cwt. of a phosphatic fertiliser, and ½cwt. of muriate of potash per acre. Oversowing with perennial ryegrass under these conditions is not warranted and will not justify the additional cost unless a high fertility level can be maintained.
4. Roll if possible.
5. Do not graze until clovers are well established.

These recommendations are intended to be applied only where pastures are very poor and lack a sufficiency of clover as a result of having been sown originally with insufficient lime and fertiliser. Whether improvement in any individual instance should be sought by oversowing or by reploughing and resowing will still require considerable thought. What action is best taken can be determined only after all factors have been taken into account.



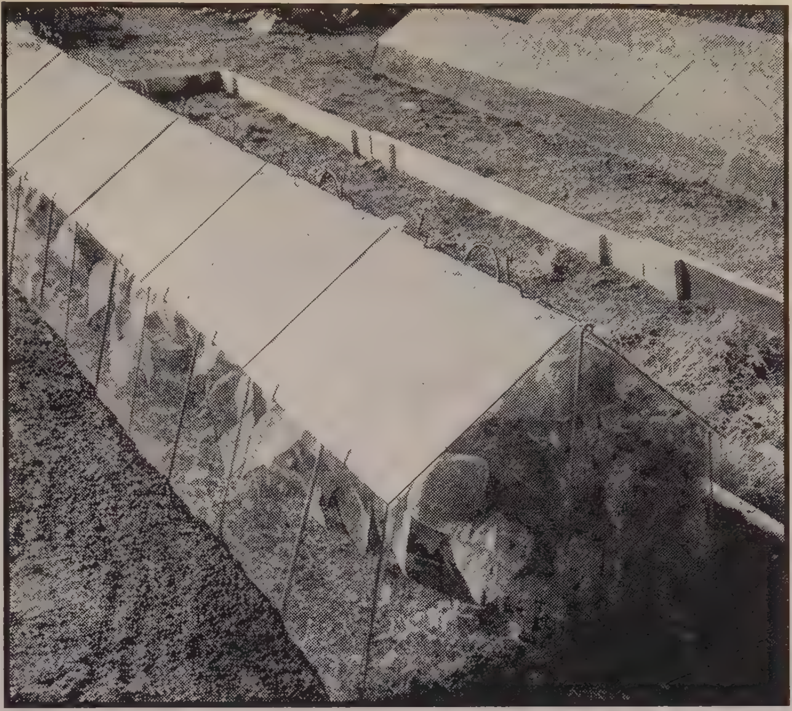
Result of oversowing. Left—Before it was oversown the pasture consisted of Yorkshire fog without legumes. Right—After the area was oversown with 3lb. of white clover per acre and topdressed with 1 ton of lime, 2cwt. of serpentine superphosphate, and 1cwt. of muriate of potash per acre a good clover sward developed.

Cloches for Early Cropping in the Home Garden

MANY years ago French market gardeners evolved a bell-shaped glass jar to protect plants from unfavourable weather such as strong winds, heavy rain, and to some extent frosts. This protector, called a cloche, enabled them to produce vegetables and other plants earlier than usual. In this article J. Coombe, Horticultural Instructor, Department of Agriculture, Christchurch, discusses the main points that govern successful use of cloches. The section of this article on work for July is by S. O. Gillard, Horticultural Instructor, Department of Agriculture, Auckland.

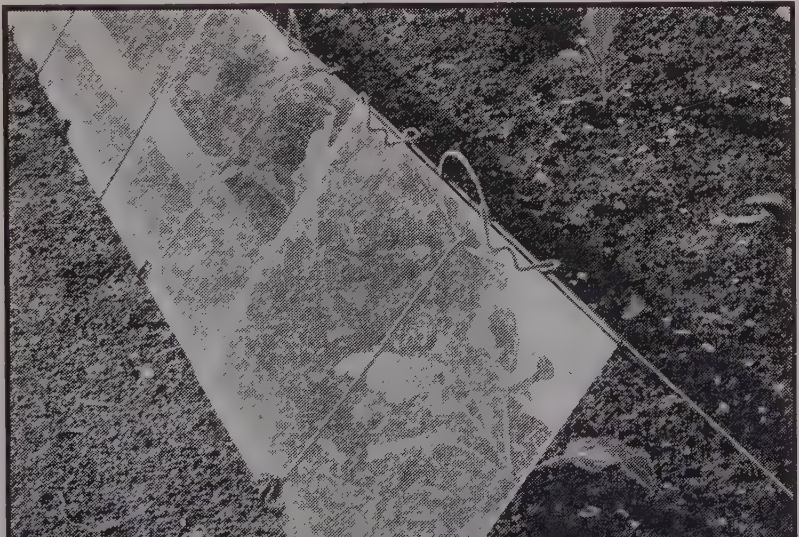
THE early French cloches did not provide ventilation and cropping was restricted to plants which would fit under the circular jar. Today cloches are made so that the units fit snugly end to end, thus allowing crops to be grown in rows. It was from this type of glass protector that the name continuous cloches was derived.

Continuous cloches were first used in England about 1912, and since then there has been a steady increase in numbers ordered until today many hundreds of thousands are in use. They were imported into New Zealand in commercial quantities about 1946, but it was not until 2 or 3 years later that they became popular. Each year many more are being purchased, as growers see their advantages for producing earlier crops and protecting later ones.



[*Sparrow*

Above—Continuous barn cloches. Those in the foreground have higher side walls than those in the background and are more suitable for taller crops. Below—Continuous tent cloches. These are suitable only for small plants or for starting crops.



[*Sparrow*

Advantages

Some of the advantages secured from continuous cloches are:—

1. The sun's heat rays passing through the glass warm the body of air and soil under the cloche. The radiation of this heat is largely prevented by the insulating effect of the glass, thus assisting the germination of seeds and increasing the root development of plants by the maintenance of a more even and warmer soil temperature. In the open, heat is dissipated very quickly as it is received, even during the day, and more rapid cooling takes place at night. Under glass heat loss is reduced and a more even temperature is maintained day and night.

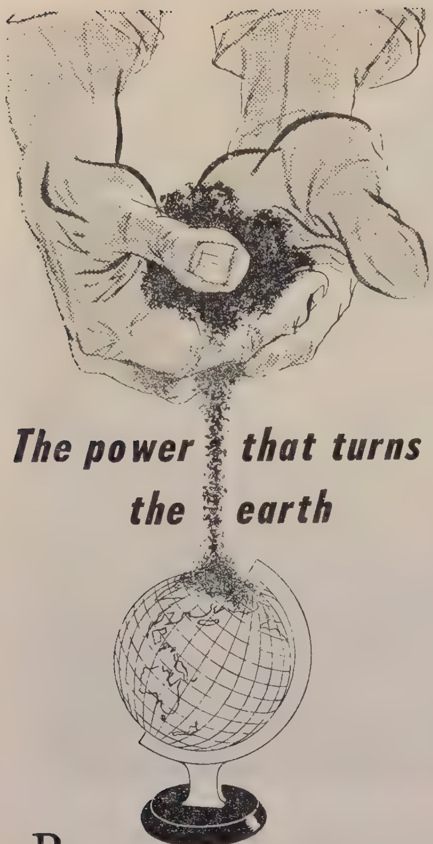
2. Cloches protect plants from winds. By their use a high humidity can be maintained close to transplanted seedlings, and with transpiration so reduced to a minimum the young plants quickly become established. Similarly drying out of germinating seeds is prevented by maintaining a cover of moist soil over the growing seed.

3. Cloches protect the seeds and plants from heavy downpours of rain, which may be detrimental to successful seed germination by eroding, baking, and cracking of the soil surface.

4. Protective sprays remain effective much longer, as they are not washed off by rain.

5. Cloches protect plants against frosts by their insulation against loss of heat from the soil during the night.

6. Cloches give protection from birds and animals.



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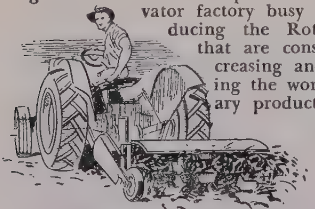

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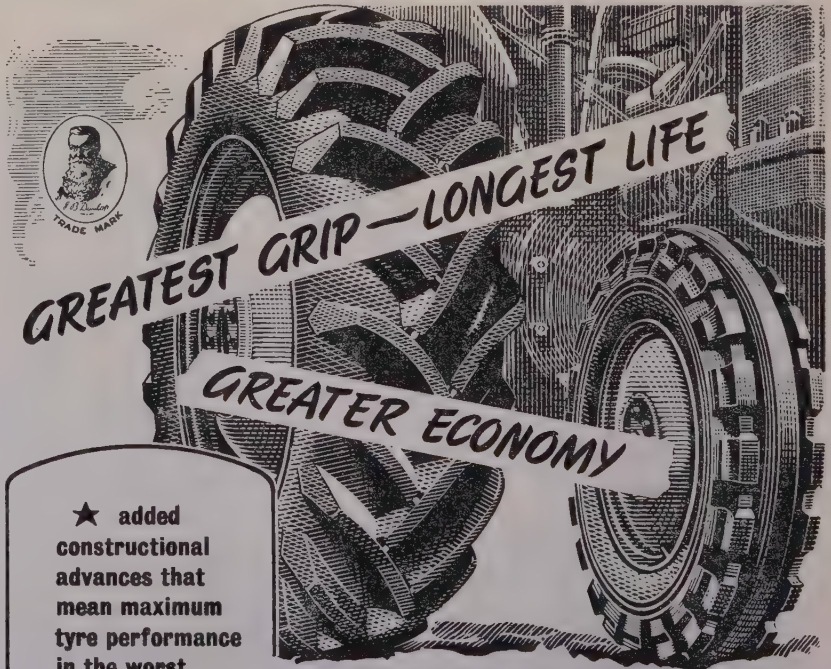

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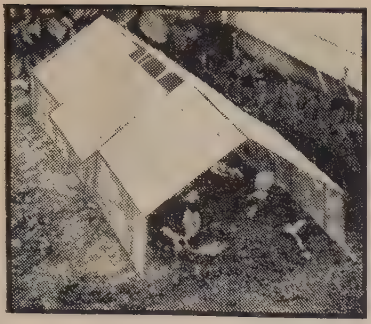


Home-made continuous barn cloches, showing one panel of centre cloche opened for ventilation.

Disadvantages

Disadvantages are:—

1. Cloches restrict weeding, cultivation, and general attention to plants; thus more time is required to carry out cultural operations.

2. Cloches are often not sufficiently tall or large to accommodate some plants throughout their life.

3. Breakages, which are costly, occur from time to time through gales or carelessness. Most of the breakages are caused by the feet being too near the glass when cultural operations are being carried out.

4. Watering, particularly in soils which are inclined to dry out quickly, is more difficult than where plants are grown in the open.

Types

There has been a number of types of cloches placed on the market from time to time, but the two main types are the tent and the barn. Both these groups are now constructed so that ventilation can be adjusted to suit the conditions, which is a definite advantage over the older, non-ventilated types.

The size and shape of tent cloches greatly restrict the number of kinds of vegetables which can be successfully grown under them. Tent cloches usually are from 11 to 15in. wide at the bases and up to 24in. long, but their shape and head-room restrict their use to small plants or for starting taller crops such as beans or peas. Tent cloches are suitable for growing lettuces, strawberries, carrots, beetroot, onions, or other similar low-growing plants.

Barn cloches each consist of four sheets of glass, one for each side wall and two for the top. Side walls are of various sizes, generally from 6 to 12in. Cloches having 9in. side walls have head-room sufficient for a variety of crops. A single line of barn cloches can be planted with two or three kinds of vegetables at the same time, as they have wide bases and almost perpendicular side walls. Adaptors are available for barn cloches to enable the heights of side walls to be increased so that tall plants such as tomatoes can be accommodated.

A less common type of cloche is the flat top or box cloche. It has perpendicular walls with a further sheet of glass laid horizontally from wall to wall, thus forming a three-sided glass box. This type has been used to some extent for tall-growing plants.

Site

In most home gardens there is a position which is sheltered from cold winds and receives a great deal of sunshine. It is in such a corner that cloches can be used to greatest advantage. Possibly this position has always been reserved in the past for the earliest or tender crops, but if cloches are used in such locations, the maturity of fresh vegetables can be hastened by as much as 3 or 4 weeks.

The direction of the rows of cloches will be determined by the lie of the section. Some authorities claim that it is best for the rows to run east and west for early-spring work and north and south for later-sown crops, but this point does not seem to be very important. Where two or more crops are being grown together under one row of cloches which are running east to west it is important that the faster- and taller-growing crops are placed on the south side so that they do not shade the slower-growing ones. In many places it is better if the rows are placed so that they are at right angles to the prevailing wind. This gives protection to rows of vegetables which may be in between two rows of cloches.

On sloping land the rows should run across the slope, not down it.

Soil Preparation

One of the most important factors when growing crops under cloches is to maintain the humus content of the soil at a high level. Not only does this assist in decreasing the cracking of the soil surface, but it also assists greatly in retaining soil moisture. Undoubtedly farmyard manure is the best to build up the humus content, as it supplies many of the plant foods at the same time, but many gardeners are unable to secure supplies of this manure. Compost made from vegetable waste and any garden plants which are not affected with bacterial or virus diseases and light hedge and lawn clippings can also be used to build up the humus content of the soil. When any of these materials are used care should be taken to see that they are well rotted down before seeds or plants are grown; otherwise nitrogen starvation may occur while decomposition is continuing.

Before seed is sown the soil should be dug over and the compost or stable manure forked through it. This method of preparation is more satisfactory than simply burying refuse some inches below the surface.

High-sided continuous barn cloche fully opened up for ventilation.

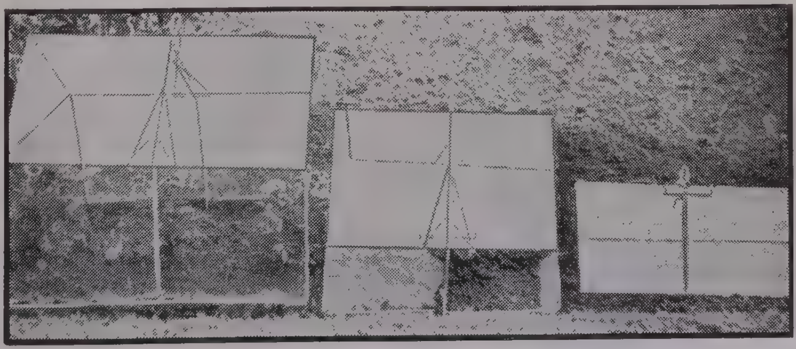
Fertilisers containing the three main plant foods (nitrogen, phosphates, and potash) should be applied according to the requirements of the crop grown and worked into the soil during its preparation. Recommendations regarding the kind and quantity of fertilisers required by the various kinds of vegetables are given in Bulletin No. 342 "The Home Vegetable Garden", which is available from main offices of the Department of Agriculture for 2s. 6d., post free.

Drainage should be attended to, particularly on heavy or wet soils, before crops are grown under cloches. Although cloches keep heavy rain from affecting the soil surface, they do not assist drainage on badly drained areas. Where gardens are naturally low lying and inclined to be wet, beds can be considerably improved by mounding them in convenient widths and leaving drains or low paths between beds. These drains should all be connected to a main outlet so that the excess water can be drained well away from the beds.

When beds are built up in this manner they should be sufficiently wide to take two rows of cloches with a gap of about 6in. between the rows.

Sowing or Planting

Cloches should be placed in position from 10 to 14 days before seed is sown



Three sizes of continuous cloches. Left—High-sided barn type. Middle—Low-sided barn type. Right—Tent type.

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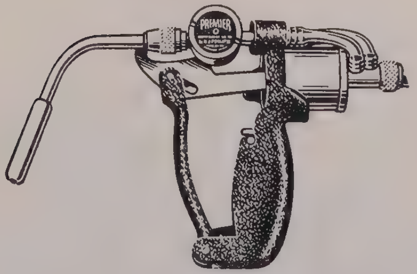

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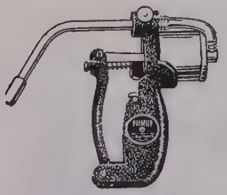

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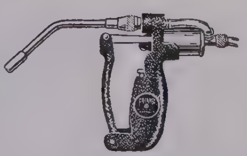

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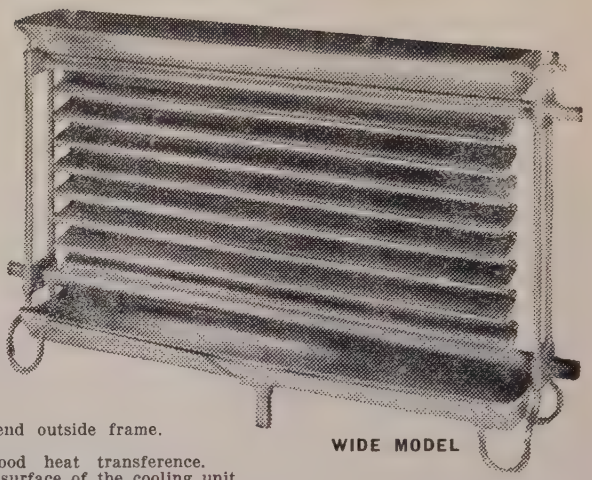

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to allow the soil sufficient time to become warmed. It is more important to do this for seeds sown in the colder months of July, August, and September than it is for the later crops sown from October onward. The soil should also be warmed in a similar manner before tender plants such as tomatoes and cucumbers which have been raised in a glasshouse are transplanted.

Sowing or planting times for the various kinds of vegetables under cloches vary considerably from the far north to the southern parts of New Zealand. Generally, crops such as peas, beans, carrots, turnips, beetroot, onions, radish, and spinach can be sown from 4 to 6 weeks earlier than is the normal practice without the protection of cloches. Crops such as tomatoes, marrows, cucumbers, and sweet corn, which cannot be grown under cloches throughout the life of the crop owing to their size, can also be set out about a month to 6 weeks earlier than is usual for outdoor crops of this type, but they should not be planted too early, as they may outgrow the cloches before the danger of frosts is over. Lettuces can be grown successfully under cloches throughout the greater part of the year.

When fine seeds are sown it is an advantage to place a sheet of newspaper over the soil until the seeds have germinated to stop drying out of the surface during periods of very bright sunshine.

Sometimes it is an advantage to shade the cloches for a few days after plants such as tomatoes or cucumbers have been transplanted to stop excessive transpiration from the plant until the roots have become established. One of the best materials for this purpose is a mixture of lime and water, as it can be splashed on with a brush and is easily removed when required. Flour and water is not suitable when shading is required only for a few days, as it is too hard to remove.

The width between each row of plants depends to a great extent on the kind grown. Generally, the quicker-maturing varieties are selected for cloche growing. Most of these are shorter than the main-crop or later varieties and can therefore be planted closer, but care should be taken not to overcrowd the plants, as this restricts their development. It is much better to have fewer, well-developed plants than a greater quantity of poor ones. Diseases and insect pests are more difficult to control when plants are badly crowded.

Continuous tent cloches being used to start cucumbers.

The following is a guide to the number of rows of plants that can be grown successfully under the normal barn cloche: Carrots 4, beetroot 3, turnips 3, peas, dwarf beans 2, and lettuce 3. The number and the distance apart of plants such as tomatoes, cucumbers, and marrows that can be grown will depend on the length of time it is intended to keep them cloched.

Various combinations of crops can be grown quite successfully side by side under the one row of cloches, but some crops grow much faster than others and these faster-growing ones tend to smother the slower crops. It is also wise to plant root crops such as carrots close to the side walls, where they get more moisture, and fibrous-rooted plants such as lettuces in the centre row.

Some of the combinations that can be grown successfully in a barn cloche are such plants as peas, beans, or lettuces in the centre, with a row on either side of carrots, onions, turnips, or beetroot.

Watering

Watering within the cloches should not be carried out after sowing or planting, as it tends to cause caking of the soil and to reduce aeration. Provided the soil has received adequate quantities of humus and has been thoroughly moistened before sowing or planting, sufficient moisture should be available to maintain plant growth. Although the lateral movement of water in the soil is not great, a little movement in this direction does take place from water running down the sides of the cloche, and as most cloches are not more than 2ft. wide, it is not long before the plant roots extend across the cloche. Another satisfactory method of watering is to dig shallow trenches along each side of the row of cloches and fill this trench with water when necessary. Watering is one of the greatest problems with the new type of steel frame cloche recently developed in England, which is 4ft. wide.

In some of the very porous or sandy soils it has been necessary to apply water to the soil in the cloche during dry weather, particularly for very leafy plants such as marrows and cucumbers. If this becomes necessary when frosts are likely, care should be taken that watering is not carried out in the late afternoon. It is much better to apply water earlier in the day so that the plants are dry before nightfall.

Wet plants and soil cause high humidity conditions ideal for the development of many of the fungous diseases which attack plants.

When only a few plants of marrows, cucumbers, or melons are grown under cloches watering can be carried out by placing a jam tin with a small nail hole in the bottom close to the root of the plant and filling the tin with water when required. The water gradually seeps into the soil without wetting the soil surface or the plant foliage.

Small, home-made, low-sided barn cloches. French beans were started under them first and the cloches were then moved over to start cucumbers.

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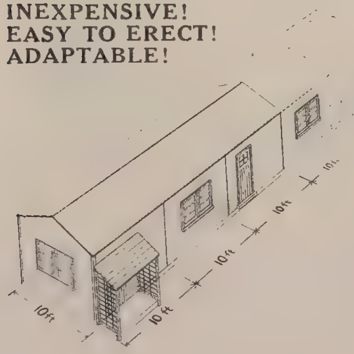

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1. After handling animals, never put hand to mouth without washing. Make sure children wash hands before eating.
2. Wash carefully, all vegetables and fruit eaten raw. They, too, can harbour the tiny tapeworm eggs.
3. Never throw raw liver or lungs of sheep to dogs. Cut offal into slices and boil first. Otherwise, burn or bury it. It is here that dogs become infected.

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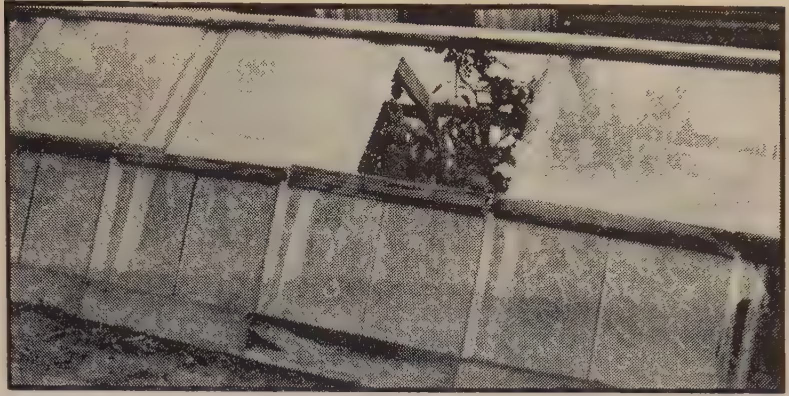


Large, home-made, continuous barn cloches suitable for tall plants; one top glass is opened for ventilation.

Ventilation

It is necessary to close the ends of each row of cloches to obtain good results. A sheet of glass is most suitable for this, but a piece of wood or other flat building material can be used quite satisfactorily. Unless the ends are closed the cloches act as a funnel and the growth of plants may be seriously retarded. Open ends also allow much of the warmth to escape from under the cloches.

In winter the cloches should be placed end to end close together. The small gaps along the eaves and at the top will allow adequate ventilation. During the warmer part of the day more ventilation can be given if necessary by adjusting the ridge ventilators.

In summer extra ventilation can be secured by leaving a gap of up to an inch between cloches in the row. If this is not sufficient with the adjustable ventilation open to its fullest extent, a pane should be removed from every third or fourth cloche.

At times during very hot weather it is essential to shade the glass to stop "scorching" of the foliage and fruit of plants such as tomatoes or strawberries. Lime or flour and water wash is suitable for this purpose.

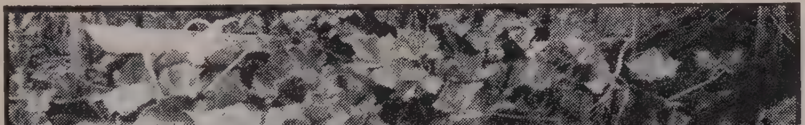
Weeding and Cultivation

The easiest method of carrying out weeding and cultivation is to take cloche No. 1 from one end of the row up to the far end, then weed or cultivate the area exposed; when this is completed place No. 2 cloche over the area already finished. No. 3 is then moved to No. 2 position and so on down the row. No. 1 cloche would then take the place of the last one in the row. By this method each cloche except No. 1 is moved only once during each weeding; the fewer the moves the less the risk of breakages.

General Points

A few cloches in the home garden will be found ideal for ripening off and protecting plants in autumn. Late crops of tomatoes can be protected from early-autumn frosts by cutting the ties from the stakes, carefully laying the plants down in a continuous row, and placing cloches over them. Clean straw should be spread over the soil before the tomato plants are laid in position to prevent soil fungi from rotting the fruit. Onions can be ripened off much better under cloches, particularly during wet weather. This thorough ripening or drying off considerably lengthens their storage life.

When cloches covering tall crops such as tomatoes become overcrowded they can be lifted and stood on their ends close to the plants. Not only does this give the plant protection from the wind, but a certain amount of heat is reflected from the glass.



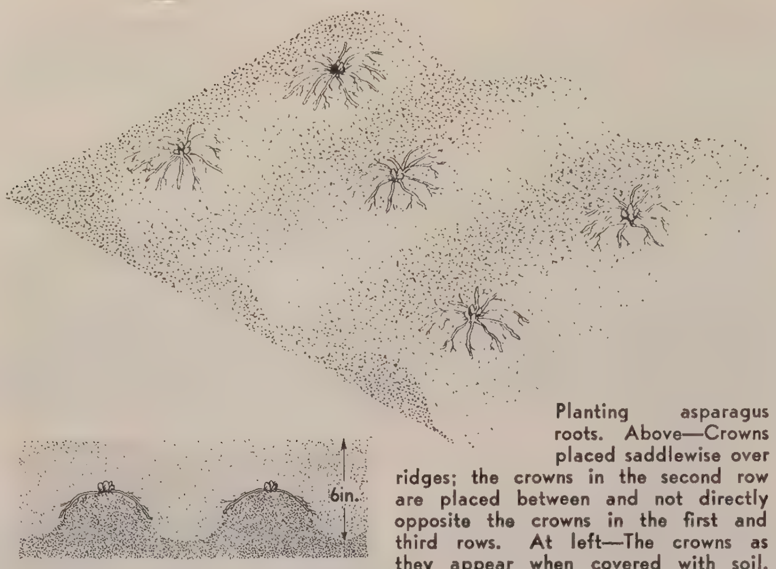
Upper—Cucumbers (first harvested in early December) grown under cloches in Christchurch. One top glass was removed to allow the plants to run outside the cloches. Lower—Fully grown tomato plants in Christchurch lying on straw under continuous barn cloches which have been whitewashed to stop sun scald. Harvesting began in early December.

Diseases and Pests

Though protective sprays and dusts are not so readily washed off plants under cloches, it is more difficult to keep diseases in check under cloches than it is when the plants are grown unprotected in the garden, as diseases or insects generally increase more rapidly when they are sheltered from the weather. It is also frequently found that soil pests such as woodlice, slugs, and snails are much worse on soils which have received large quantities of compost or stable manure. Therefore a watch should be kept for these pests and remedial treatments carried out when they are first seen. Recommended control measures for diseases and insect pests of vegetables are given in Bulletin No. 342 "The Home Vegetable Garden", or advice can be obtained from district officers of the Horticulture Division of the Department of Agriculture.

Work for July

IN July the weather is seldom suitable for extensive work in the garden and except for digging and general tidying up the home gardener should make the most of this opportunity to attend to odd jobs which could not be done in the busy season. Garden equipment and seed boxes can be prepared, frames made, and the garden shed cleaned and tidied. Garden tools can be sharpened and arranged so that they can be found easily when required.



Planting asparagus roots. Above—Crowns placed saddlewise over ridges; the crowns in the second row are placed between and not directly opposite the crowns in the first and third rows. At left—The crowns as they appear when covered with soil.

Any additions or alterations to garden layout, shelter, or drainage should be finished without delay. Weed growth should be cleared from neglected corners and beneath hedges, as it not only harbours pests of many kinds, but may act as a host for fungous and virus diseases. This work will also improve the appearance of the garden. Stored crops of potatoes, pumpkins, and onions should be examined, any showing signs of decay should be removed, and shoots on potatoes should be rubbed off.

Spray apparatus should be overhauled so that it will be in good order when required and garden requisites (spray material, fertilisers, seeds) checked over and if necessary new stocks procured so that they will be on hand when required.

Asparagus and rhubarb beds can be cultivated and, if this has not been done already, manured. New beds for asparagus and rhubarb can also be prepared and planting can be done as soon as the beds are ready. Green crops growing on land required for early cropping should be dug in during July to allow decomposition to take place before seed sowing or planting is done in spring.

The lighter types of soil that are not too wet and sticky can be dug over or trenched to improve aeration and drainage. Most soils are improved by being left rough after digging to expose them to the weather. This not only helps to break up the soil, but exposes insect pests or their eggs to the weather or to birds.

Trenching or double digging and subsoiling loosens, pulverises, and deepens the topsoil, allowing the roots of the plants to grow more freely in it, and facilitates the admission of air and water. It is also a means of incorporating manurial substances into the soil.

It is important when deep digging or trenching not to bring the subsoil to the surface. Many gardens give disappointing results if the subsoil is brought to the surface, where it frequently forms an infertile and nearly unworkable mass for many years.

Sowing and Planting

Except in very warm localities little is gained by sowing or planting out in the open before August. Even in North Island districts where climate and soil conditions are more favourable, sowings and plantings should be limited to the hardier vegetables. The following can be sown in July:—

Broad beans: In light, well-drained soils and planted on ridges. Good varieties are Coles Dwarf, Broad Windsor, and Long Pod.

Spinach: Prickly-seeded (winter) varieties sown on raised and well-manured beds.

Silver beet: In mild districts in sunny, sheltered positions for planting out later. Good varieties are Lucullus and Fordhook Giant.

Radish and spring onions: In slightly raised beds where they get the most sunshine. Good varieties of radish are French Breakfast and White Icicle and of spring onion White Lisbon.

Peas: In the warmer North Island districts. Sow on ridged rows if soil is heavy early dwarf varieties such as William Massey or Little Marvel.

In cool frames or boxes, with a glass top, sow for planting later:—

Lettuce: Imperial 615, Neapolitan Winter.

Cabbage: Golden Acre, Henderson's Succession.

Cauliflower (Northland and Auckland): Early London.

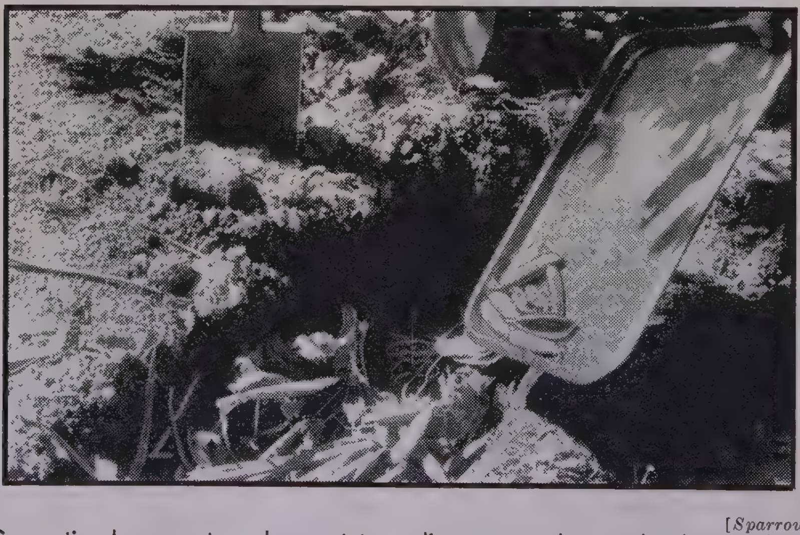
Tomatoes (in mild districts): Dwarf —Adelaide Dwarf, Early Chatham. Tall—Potentate, Moneymaker, Carter's Sunrise.

Planting out will be confined to cabbages and cauliflowers, which in North Island districts can be set on ridged drills. Suitable varieties of cabbage are Flower of Spring and Enfield Market and of cauliflowers, Early London and Phenomenal Early.

Herbs

July is a good time to plan the establishment or extension of the herb garden. A narrow border at the foot of a fence and beside a path where access is easy in all weathers should provide sufficient space in the average garden. The soil should be deeply dug and well manured, as many herbs in general use are likely to occupy the bed for several years. Sage, thyme, mint, parsley, and chives are most in demand, and seed or cuttings are obtainable from most seedsmen. Mint, because of its habit of spreading, should be planted where it can be kept in check. A good method is to enclose it with corrugated iron or some similar boxing.

A wide range of herbs may be grown both to add interest to gardening and to widen the scope of seasonings for cooking. Lists of these herbs and cultural details were given in the home garden article in the April issue of the "Journal" (page 296).


[*Sparrow*

Composting house waste such as potato peelings, pea pods, etc., by digging them into the garden is to be preferred to burning them.

Recent Research Work

Sulphur Responses in North Otago

THE use of superphosphate as a fertiliser in North Otago has not been universally successful. There are many areas where soil tests suggest that the soil should respond to it and it does not, and conversely there are areas where soil tests suggest it should not respond to it and it does. Such conflicting evidence requires close investigation, and it is interesting to record the work done in North Otago with trace elements, as it affects this problem.

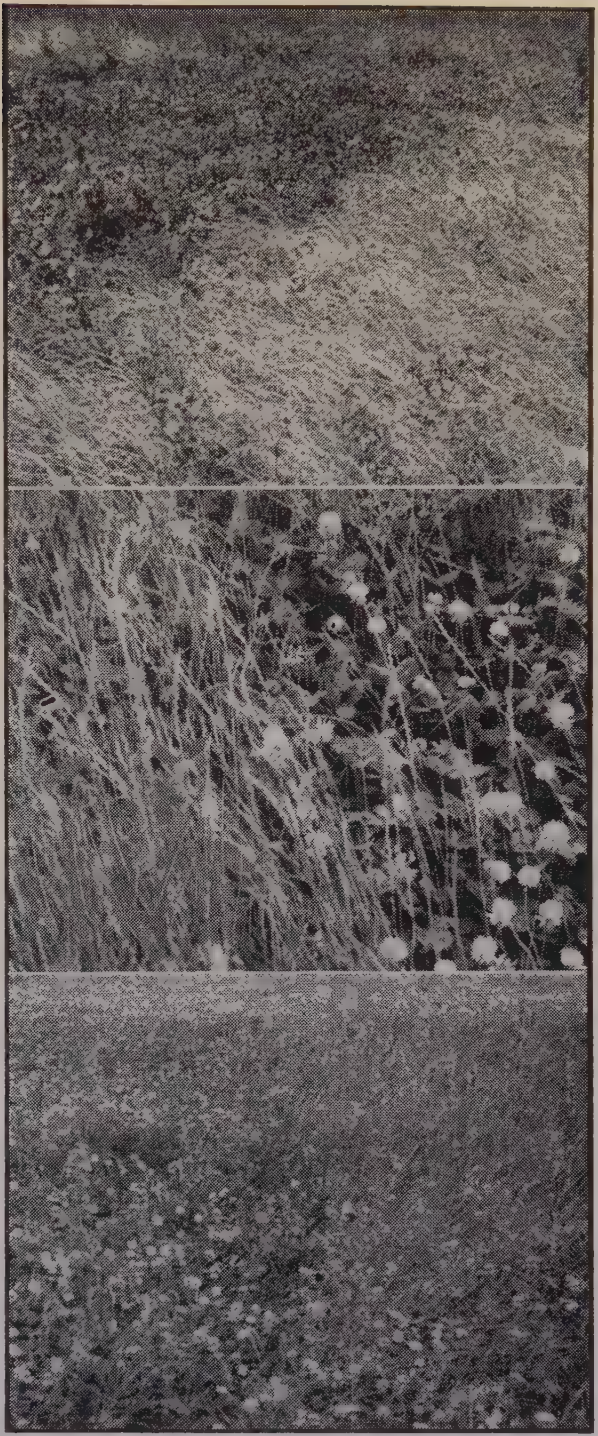
INITIAL RESEARCH

THE initial work done with molybdenum was partly the result of the inconsistency of the lime requirement tests, which indicated the need for only moderate lime dressings, though in practice excellent results were achieved by heavy liming. This work began in Otago in 1945 and in North Otago in 1951. The discovery of extremely deficient molybdenum areas provided the reason for the unsuccessful use of phosphates on some low phosphate testing soils. The reason for responses to superphosphate on high phosphate testing soils also required investigation, especially on the high phosphate testing "tarry" soils of North Otago, on which marked responses to superphosphate are obtained, because tests on these soils have shown a level of available phosphate much higher than that usually associated with responses to phosphatic fertilisers.

TRIALS WITH SULPHUR AND SULPHATES

Trials in the early 1930s showed that some soils in Central and North Otago gave responses to sulphur. It appeared reasonable, therefore, that work on the tarry soils, which responded so readily to superphosphate despite their high phosphate content, should be undertaken with sulphur and sulphates. Superphosphate contains a fairly high percentage of sulphates, 40 per cent. of its weight being gypsum or calcium sulphate. Three preliminary trials were laid down on the heaviest of the tarry soils (Waiareka complex) with various sulphates and elemental sulphur. Phosphates containing no sulphur and superphosphate were also included, and other plots were dressed with boron and molybdenum compounds. One of these trials, which was on vigorous clover pasture and which was closed from grazing, has given outstanding responses to superphosphate, sulphates, and sulphur, but no response to phosphates without sulphur. These results were confirmed by another trial, which was closed from stock for a shorter period. The third trial, which was continuously grazed, did not show visual responses. Further work is required on these areas to evaluate the rates at which these sulphates can be applied and to investigate methods of application. No definite recommendations can yet be made, but it is possible that a more economic fertiliser than superphosphate for supplying sulphates (not phosphates) to these soils may be indicated from future work.

—*W. R. LOBB*



Plots in the North Otago sulphur response trial. Upper—The sulphur plot, on left of illustration, shows as a dense mat of clover growth. The plot in the foreground received borax, which gave no response. Middle—The plot on left received sodium molybdate and contrasts with the dense clover in the sulphate plot on right. Lower—The plot on left, where clover growth is stronger, received superphosphate, which contains about half its weight as gypsum or calcium sulphate, and that on right oxalic superphosphate, which does not contain gypsum.

Control of Buttercup

Spraying of pastures with 2,4-D for buttercup control is best carried out in spring as soon as the weed begins vigorous growth. Treatment can be carried out earlier, but should not be delayed after the plant is 4in. high. A complete kill of the annual species of buttercup is assured where ¾ pint of the oil-based ester or ¾lb. of the sodium salt of 2,4-D is applied per acre. Although many farmers get satisfactory results from the application of only ½ pint of the ester or ½lb. of the sodium salt, failures at this lower rate are common. Control of the less common perennial species of buttercup found only in certain districts is more difficult and repeat applications of the sodium salt of M.C.P. at 4 to 5 pints are required. Preparations based on 2,4-D acid have given unsatisfactory results in trial work. The first treatment should be carried out at the flowering stage followed by autumn or spring applications to the regrowths. Partial failures are due more to misses with the spray than to any other cause. If these misses are to be avoided, it is essential that a marker be dragged from one end of the spray boom. A 3 to 4ft. length of railway line to which spikes have been welded is excellent for this purpose.

—*G. L. BANFIELD*

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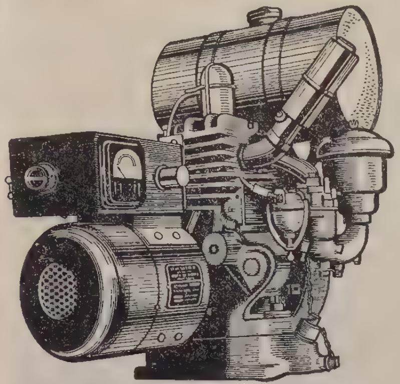

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Winter Litters of Pigs

FOR efficient pig production on a dairy farm it is essential that sufficient pigs should be on hand in spring to cope with the rising tide of dairy by-products available then. The supply of these pigs depends on the successful rearing of litters farrowed in May and early June and every care should be taken to avoid losses in these litters. In this article I. H. Owtram, Extension Officer in Pig Husbandry, Department of Agriculture, Wellington, deals with the care of these litters.

DURING the period from when the cows begin to calve until dairy production reaches its peak in December the supply of dairy by-products (skimmed milk and whey) available for feeding to pigs rises steadily. To attain maximum pig production sufficient pigs must be on hand to cope with this supply if waste is to be avoided, either direct waste of skimmed milk or whey or waste by overfeeding baconer pigs in the later stages of fattening and so producing over-fat carcasses, for which a lower return is obtained. The supply of these pigs depends on the successful rearing of litters farrowed in May and June. Heavy losses in these litters are serious, as the replacing of pigs that could have been reared by pigs bought in spring is very costly and frequently very difficult, as few store pigs may be available.

Large, Strong, Healthy Litters

For a good start large litters of strong, healthy piglets are required, and to get these reasonable care must be given to the sow during the period from mating to farrowing. Too often sows are neglected and left to fend for themselves after they have weaned their summer litters, which generally takes place about the end of December. As this is in the middle of summer, the belief is unfortunately prevalent that a sow can look after herself at this time of year, and the results of this policy are not altogether satisfactory. A sow that has just reared a good litter has, even under the best of farm management, lost some weight, sometimes a very considerable amount. This her owner often does not notice, as he sees the sow every day and the change is gradual. If the sow is expected to produce and rear another good litter, she must be given a chance to regain the weight she has lost while rearing the previous one, and she will have very little chance of doing this if she is turned out to fend for herself and get all her food from grazing.

This does not mean that grazing on good clover pasture is of no value. It makes a worthwhile contribution to the maintenance of the sow and reduces the amount of supplementary feed that she requires, but for satisfactory results she must have this supplementary feed and it is after weaning the summer litter that this is often neglected, with correspondingly poor results in the winter litter. The first point to look to in avoiding unnecessary losses in winter litters is not to neglect the sow between mating and farrowing. She should be fed 2 to 5 food units a day. Skimmed milk or whey can be used if sufficient is available; whey, of course, should be supplemented with 1 to 2lb. of meat meal. If there is not enough skimmed milk or whey to supply the ration required, it should be brought up to the standard required with meat meal and grain meal; home-grown grain can be used. As free a range on pasture as is possible should be allowed, as this ensures plenty of exercise, an important point in keeping the sow healthy.

Good Farrowing Quarters

Sows farrowing in May and June require good farrowing quarters if heavy losses at farrowing and during the first few hours afterward are to be avoided. Farrowing houses must be weather proof, draught proof, and warm, and give complete control over the sow, which should be put into farrowing quarters in ample time to settle down there before farrowing. At this time of year if a sow breaks out of her house and farrows in the open, the chances of losing practically the whole of the litter are great.

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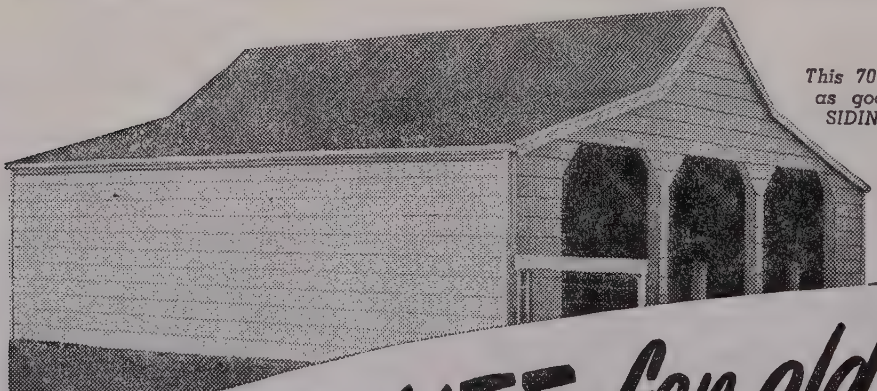

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Isn't life wonderful! [*Tru-Tone*

Steps should be taken to prevent the newly born piglets from wandering too far away from the sow, and the best way to do this is to fix a 6in. x 1in. board across the entrance to the sleeping quarters. A brooder in one corner of the farrowing pen is particularly valuable at this time of year, as the light and warmth attract the piglets and keep them out of harm's way. Details of brooders were given in an article in the April issue of the "Journal". At this time of year brooders will soon repay their cost in saving piglets.

Bedding

A certain amount of bedding, preferably straw or wood shavings if they are obtainable, should be provided. Hay, which has to be used in most cases, should be used sparingly, as piglets very often get tangled up in it. Hay should be put into the farrowing house when the sow is first put there to give her time to consolidate it and break it up; this lessens the risk of piglets becoming covered in it and overlain. During the 24 hours before and after farrowing the sow should be fed very lightly and given plenty of clean water to drink.

If the sow is quiet enough to be handled when she is farrowing, it pays to give her attention, as this may mean the saving of piglets that would otherwise be lost. However, if the sow resents anyone being near when she is farrowing, it is better to leave her alone, as more harm than good will be done by trying to assist her.

During the first week after farrowing the sow should be fed lightly and the amount of food increased gradually until she is receiving her full ration, which should be 4 food units for the sow's maintenance and 2/3 unit for each pig in the litter. Drinking water should be always available. If the weather is suitable, the sow and the litter should be let out for a run on good pasture for an hour or two as soon as the piglets are running round. If the weather is bad, a clean sod of turf should be dug and put into the farrowing house for the piglets to deal with. A run out in the paddock, or failing that the turf, as soon as possible after farrowing is a good insurance against trouble from anaemia.

Keeping Houses Warm

It is in the first week after farrowing that warmth in the house is of the greatest importance. The ideal temperature for piglets of this age is about 70 degrees. F. Where a brooder is used no difficulty will be experienced in maintaining sufficient warmth. Even without it it is possible in a well-built and well-insulated house to maintain temperatures considerably higher than those outside. Heat losses, through walls and through roofs particularly, can be controlled very largely by insulation and much more easily than might be assumed, as an air space forms excellent insulation. Hollow concrete blocks are a good material for walls and an air space can be provided in the roof by placing sarking on the lower side of the rafters instead of directly under the roofing material.

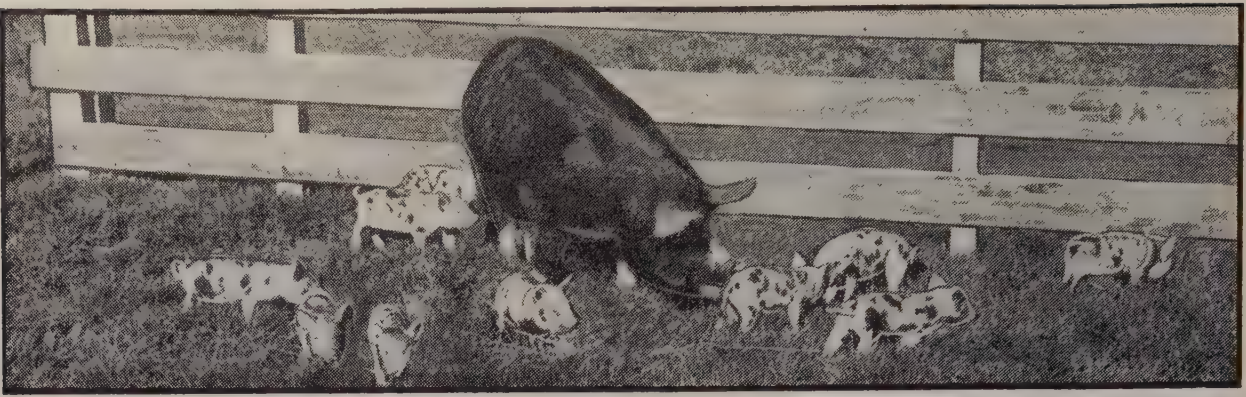
Creep Feeding

During the first 3 weeks of their lives piglets rely entirely on the sow's milk. From 3 weeks onward they will take increasing quantities of food on their own and this is fed to them in a creep. The position of the creep is important, as the nearer it is to the sleeping compartment the earlier the piglets can be coaxed into it. It pays also to have the creep under a roof, as this prevents the spoiling of meal by the weather. Meal and milk must be provided in the creep. The meal should be fed dry in a self-feeder or a separate trough from the milk and should be available all the time. A suitable meal mixture consists of one-third meat meal and two-thirds barley meal. If possible, milk should also be always available in the creep, but care must be taken that it does not go stale and that the trough is kept clean.

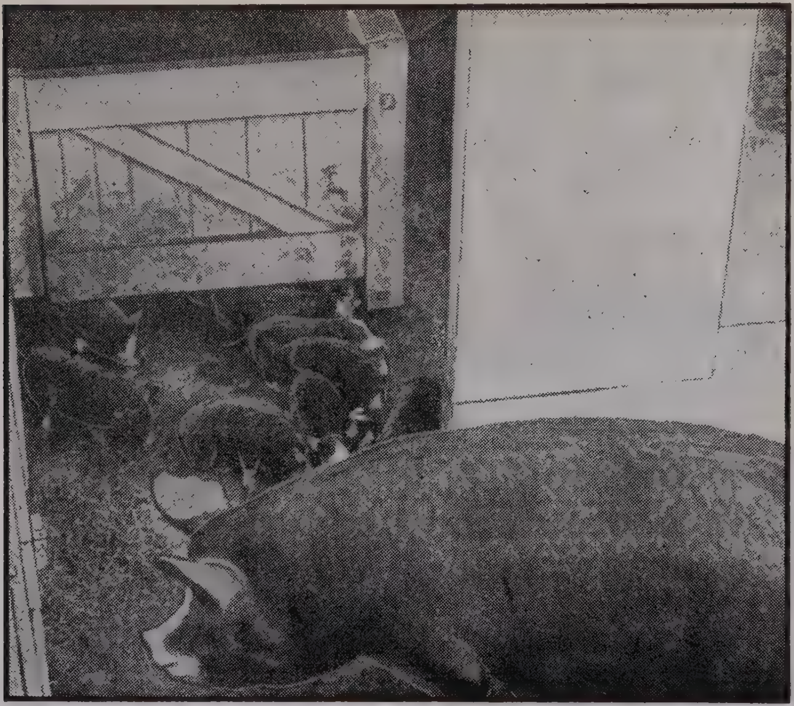
Creep feeding is very important; it is not only the way to produce heavy weaners (40lb. or more liveweight), but pigs make more efficient use of the feed given them at the creep-feeding stage than at any other time in their lives. Research has shown that during these first 4 weeks after farrowing it takes 4 food units or 4lb. of feed fed to the sow and litter to increase the total liveweight of the litter by 1lb., but that during the next 4 weeks (that is, up to weaning), when the piglets are feeding well in the creep, it takes only 3 food units or 3lb. of feed fed to the sow and litter to increase the total liveweight of the litter by 1lb. This shows very clearly the value of creep feeding.

Guile is sometimes necessary to get the piglets to feed well from the creep at an early stage. Shutting the sow out and leaving the litter in the creep area for an hour or two is a good method, and dry meat meal or pellets made of meat meal and fat are also good for getting piglets started. Once

At left—Warm and comfortable inside.



Above—Run out in fine weather on good pasture. Below—Well-planned creep under the roof at the side of the sleeping floor.



[*"New Zealand Farmer"*

that hurdle is over no further trouble will be experienced.

Boars in the litter should be castrated at 3 weeks or earlier—the earlier castration is done the less shock it is to the piglets and the quicker they recover. Care and cleanliness are essential; a good antiseptic should be used and the pigs should be washed before operations are begun. The incision should be made as low as possible to ensure good drainage of the wound.

Weaning

Litters farrowed in May and June are ready to wean at the end of July and in August. As the weather is not usually very good at this time, more care is necessary with the weaned pigs than in summer. After the sow is removed the litter should be left in its farrowing quarters for from 2 to 4 weeks at least. The pigs must be kept warm and an excellent system is to reduce the area of the sleeping floor by fixing a 4in. x 2in. board on edge across it, leaving behind it just sufficient space for the pigs to sleep comfortably. Plenty of bedding should be put in this space. If this is done, the pigs will not foul their sleeping space and will be kept warm. Except for a period on bright, sunny mornings shutters should be kept closed.

The pigs should be fed regularly at least three times a day and should get at least 1½lb. of meal (meat meal and barley meal) a day. As the dairy herd is calving at this time, milk supplies should be adequate even though a certain amount is being used to rear calves. Colostrum, the milk from newly calved cows, should be mixed with the whole quantity of milk available for the pigs and not fed by itself, as if this is done it may cause a digestive upset. Whenever the weather is suitable the pigs should be let out during the day on to good pasture.

Pigs from winter litters are very important if the maximum return is to be obtained from the flush of dairy by-products in November and December. Unless that little extra care is given, losses among these litters will be heavy and their replacement is difficult and costly.

EDITOR: PROFESSOR H. I. MOORE.

THE JOURNAL OF THE BRITISH GRASSLAND SOCIETY

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CONTENTS OF VOLUME VII, No. 4, 1952

1. The Use of Fertilizers on Herbage Cut for Conservation. Part I. T. W. Walker, G. H. A. Edwards, A. J. Cavell and T. H. Rose.
2. Studies on the Productivity of First Year Ley Grass When Cut at Different Stages of Growth, Ensiled and Fed to Beef Cattle. T. L. Dodsworth and W. H. McK. Campbell.
3. The Chemical Composition and Nutritive Value of Welsh Hay: Comparison with Other British Hays. Part I. W. M. Ashton and D. E. Morgan.

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The Secretary, British Grassland Society, 69 May Street, Belfast, Northern Ireland.

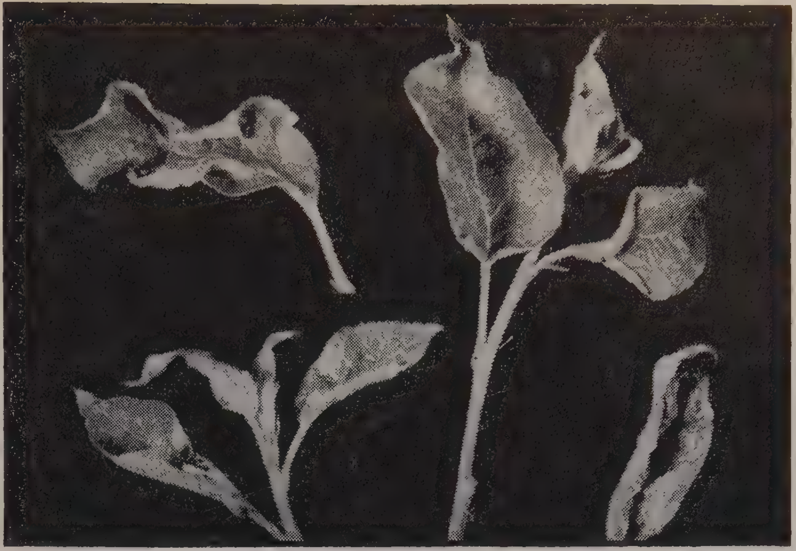
Apple Leaf-curling Midge in New Zealand

THE apple leaf-curling midge (*Dasyneura mali* Kieffer) has spread from Europe to North America and is now an established pest of apples in New Zealand. It is known to be present in Auckland, Matamata, and Palmerston North. It is a specific pest of apples and damage results from the rolling and premature dropping of leaves. L. G. Morrison, Biologist, Department of Agriculture, Wellington, here describes the history of the midge in New Zealand, its life cycle, the damage it causes, and control methods.

THE original description of *Dasyneura mali* was made by Kieffer in 1889. The adult midge is a small fly similar to the pear leaf midge. The female is 1½ to 2½ mm. long with iridescent wings 1½ to 2 mm. long; it has a red abdomen with black scales on the back, and the legs and thorax are brownish. The male midge is slightly smaller and lacks the red on the abdomen. The larval stage begins with a small, creamy-white maggot. It is this maggot which causes the damage. As the maggot grows its colour gradually changes to a pale orange, and at maturity, when 5 mm. long, the maggot is orange-red.

Damage

Leaves on terminal branches and watershoots are rolled, cease to function properly, and may drop prematurely. There has not yet been observed in New Zealand an infestation severe enough to cause stunting.

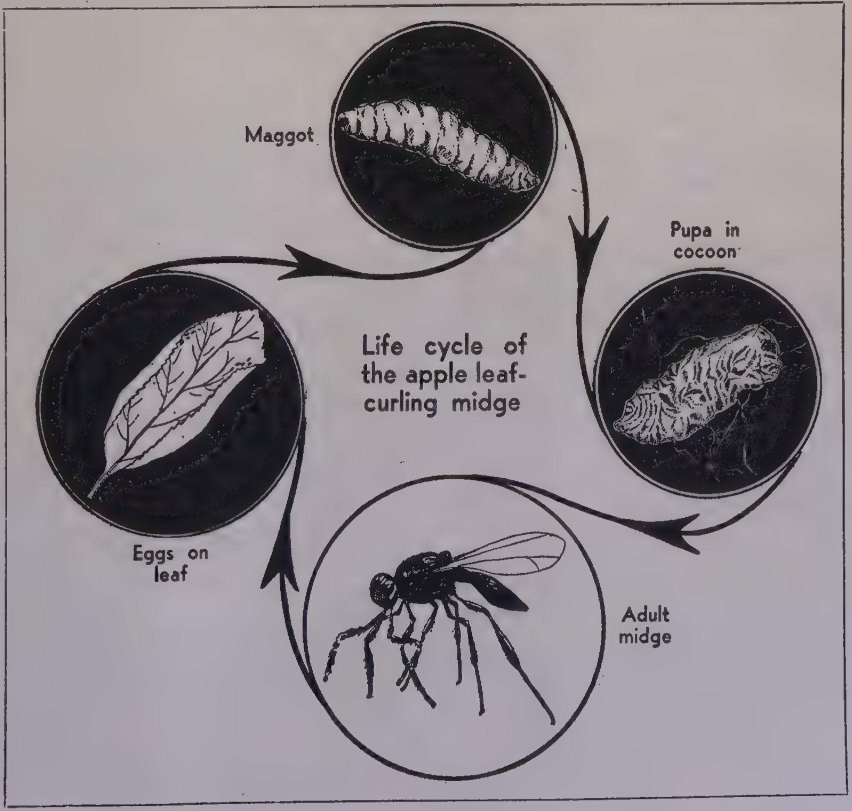


[*Sparrow*

Terminal and older leaves showing rolling caused by apple leaf-curling midge.

Distribution

In Europe the midge has been recorded in France, Germany, Italy, and England, but in none of these countries has a serious outbreak of the midge been recorded. The insect may have travelled on French stocks to North America in 1912, but it was not until 1928 that it was first recorded there in Massachusetts. It is now a pest in north-east Massachusetts, south-east New Hampshire, Maine, and New York State.



History in New Zealand

In New Zealand the midge was first recorded in 1950 at Auckland. It has now been recorded from Auckland, Matamata, and Palmerston North.

In January of 1950 a shipment of East Malling No. IX apple stocks was imported from Holland and planted in nurseries at Auckland, Tauranga, Palmerston North, Bulls, and Feilding. Two months later stocks in three Auckland and two Palmerston North nurseries were found to be infested with apple leaf-curling midge. The soil was treated with naphthalene and the foliage sprayed with commercial preparations of parathion. With the onset of winter the midge disappeared.

In December 1950 the midge appeared in the Tauranga nursery. Control measures were taken, but when the midge again appeared in December 1951 the owner voluntarily destroyed the stock by burning and the soil in the stock beds was sterilised.

No signs of the midge having been apparent elsewhere during the 1950-51 growing season, apple stocks at Auckland and Palmerston North were permitted in May 1951 to be sold, provided that when lifted they were shaken free of soil and then dipped in red oil. Trees were distributed throughout New Zealand.

The midge was next found in Palmerston North in February 1952. Immediately the movement of apple stocks was restricted from Palmerston North and from the remaining Auckland nursery which still held some original imported stocks. The Bulls nursery had been regularly inspected since 1950 and it came as a surprise when the midge was first found there in March 1952. The stocks were immediately and voluntarily destroyed. In the other affected areas requiring treatment naphthalene, being unobtainable, was replaced by D.D.T. for a soil dressing at 1lb. of 5 per cent. powder per 100 sq. yds. The parathion foliage spray was again used.

It was noted in Auckland that any stocks which had been lifted in winter, cleaned of soil, dipped in red oil, and planted in a clean area showed no sign of infection. Parathion was found to be relatively ineffective and a change was made to a foliage spray of 1lb. of 50 per cent. D.D.T. wettable powder per 100 gallons of water. Midge activity again declined as winter approached.

As growth came away next spring the midge really showed itself. By November 1952 it was found not only at the original site of infestation in Auckland, but had spread to a neighbouring orchard area. It was also found on several properties in Palmerston North. As a result of information received at this time from the Massachusetts Agricultural Experiment Station, the spray strength was increased to 2lb. of 50 per cent. wettable D.D.T. powder in 100 gallons of water. Use of this spray (applied at pink bud and petal fall, or about 1 week later) plus one or two applications per season in the regular spray schedule has been satisfactory as a control in New England. It is too soon to estimate the spray's effectiveness in New Zealand, but at present the apple leaf-curling midge is spreading, despite spraying at 3-weekly intervals. The latest report of an outbreak has come from an entirely new area, Matamata.

Life History

This account of the life history of the midge is based on Whitcomb's work in the United States of America. The life history in New Zealand has yet to be determined and may differ from that described here. Officers of the Plant Diseases Division of the Department of Scientific and Industrial Research are at present studying the life cycle.

Each female midge lays 100 to 200 reddish-brown eggs in uncurled or partially uncurled apple leaves. Eggs are laid irregularly in groups on the margins or upper sides of unfolding leaves, and the down of the leaves keeps the eggs from rolling off. Eggs hatch in 3 to 5 days and the tiny, creamy maggots start feeding on the leaf and apparently prevent it from unrolling. Feeding raises small blisters on the leaf; the blisters turn red, then black, and finally the leaf may fall. The maggots cannot survive bright sunshine for long and stay in the leaf rolls, which not only are prevented from unrolling but actually become tighter as the leaf ages.

The number of maggots per leaf varies considerably, but 28 have been found on one leaf in New Zealand. Whitcomb in the United States has reported as many as 131 on one heavily infested leaf. The maggot feeds for 20 days before pupating in a tough, silken cocoon. Most maggots leave by the ends of the leaf roll, fall to the ground, and pupate among fallen leaves and just below the surface of the ground. A few maggots crawl down the trunk of the tree and some of these may pupate under the rough bark. Occasionally pupation occurs in the leaf roll. Rainfall, which softens the rolled leaves, influences the exact time the maggots migrate to the ground. Reared specimens required 13 to 18 days for pupal development. The over-wintering generation has a pupal period of many weeks. Adult midges live 3 or 4 days. They are either reasonably strong fliers or at least can survive strong winds which blow them long distances. In the United States there are apparently four generations per year, but overlapping of generations is common.

Natural Enemies

Whitcomb has observed a tiny anthocorid bug *Triphleps insidiosa* attacking the maggots in the rolled leaves. He also reared a parasitic hymenopteron. In the orchard the presence of these parasitic wasps was indicated by emergence holes through the sides of the rolled leaves. The Entomological Research Station of the Department of Scientific and Industrial Research, Nelson, is investigating the advisability of introducing parasites into New Zealand.

Control

Whitcomb suggested summer pruning, cultivation, and the use of soil insecticides to supplement the work of natural enemies. In the United States there has been considerable success in reducing the midge population by applying soil dressings of 2lb. of naphthalene per 100 sq. ft. and then cultivating. Many different spraying experiments have been tried in the United States, but the most effective was found to be the application of 2lb. of 50 per cent. D.D.T. wettable powder per 100 gallons of water every 2 to 3 weeks to affected trees.

Investigations into the best method of chemical control are being made by the Plant Diseases Division, Department of Scientific and Industrial Research, Mount Albert, Auckland, but until the result of these investigations is known spraying with 2lb. of 50 per cent. D.D.T. wettable powder per 100 gallons of water is being continued.

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"Gall Midges of Economic Importance", vol. III, p. 35, H. F. Barnes (1948).

"Journal of Economic Entomology", vol. 27 (2), pp. 355-361, W. D. Whitcomb (1934).

Radio Broadcasts to Farmers

RADIO broadcasts to farmers will be given during July as follows:—

1XH Hamilton, 12.33 p.m.

2 July—"Ewe Abortion", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

9 July—"The Use of Lime", by J. R. Murray, Instructor in Agriculture, Department of Agriculture, Hamilton.

16 July—"Outlook for the Pig Industry", by D. J. Carter, Federated Farmers, Hamilton.

23 July—"The 4-H Club Movement in U.S.A.", by R. Gaston, Waipa district committee of the Federation of Young Farmers' Clubs.

30 July—"Renewing the Household Poultry Flock", by W. L. Jourdain, Poultry Instructor, Department of Agriculture, Hamilton.

1YZ Rotorua, 7.15 p.m.

9 July—"Pasture Utilisation", by G. A. Blake, Instructor in Agriculture, Department of Agriculture, Matamata.

23 July—"Metabolic Diseases of Cattle", by D. W. Caldwell, Veterinarian, Department of Agriculture, Hamilton.

2YZ Napier, 7 p.m.

7 July—"Spring-sown Crops", by A. G. Coughlan, Fields Instructor, Department of Agriculture, Hastings.

21 July—"Seasonal Beekeeping Notes", by L. A. Griffin, Apiary Instructor, Department of Agriculture, Hastings.

3YA Christchurch

6 July (12.20 p.m.)—"Spraying in the Home Garden", by J. Coombe, Horticultural Instructor, Department of Agriculture, Christchurch.

13 July (12.20 p.m.)—"Heating Your Home", by Eirene E. Unwin, Field Officer in Rural Sociology, Department of Agriculture, Christchurch.

16 July (12.33 p.m.)—"Review of New Zealand Journal of Agriculture", by E. G. Smith, Fields Instructor, Department of Agriculture, Rangiora.

27 July (12.20 p.m.)—"Soil Pests in the Home Garden", by L. C. Hurndell, Horticultural Instructor, Department of Agriculture, Christchurch.

4YA Dunedin, 9.15 p.m.

1 July—"Pruning of Fruit Trees and Shrubs", by A. G. Kennelly, Horticultural Instructor, Department of Agriculture, Dunedin.

15 July—"Poultry Troubles Avoided", by W. G. Proudfoot, Poultry Instructor, Department of Agriculture, Dunedin.

29 July—"Minor-element Investigations in North Otago", by W. R. Lobb, Instructor in Agriculture, Department of Agriculture, Oamaru.

Regular Sessions

1XH Hamilton, Tuesdays at 8 p.m. (Frankton stock market report), Wednesdays at 12.33 p.m. (report from Ruakura Animal Research Station), Thursdays at 12.33 p.m., Fridays at 8 p.m. (Waikato stock review).

1XN Whangarei, Mondays at 8 p.m., Wednesdays at 8 p.m. (Northland stock market report), Fridays at 8 p.m.

1YA Auckland, Mondays at 7 p.m. (Auckland stock market report), Tuesdays at 12.35 p.m., Wednesdays at 7 p.m., Thursdays at 12.33 p.m.

1YD Auckland, Thursdays at 7.30 p.m.

1YZ Rotorua, Mondays at 12.33 p.m. (Waikato stock review), fortnightly on Tuesdays at 12.33 p.m. (Federated Farmers' session), Tuesdays at 6.55 p.m. (Frankton stock market report), Thursdays at 12.33 p.m., Thursdays at 7.15 p.m. (farm talks alternating with session for Bay of Plenty farmers), fortnightly on Fridays at 12.33 p.m. (pig council talk).

2XA Wanganui, Wednesdays at 8 p.m. (Wanganui stock sale report), Thursdays at 8 p.m.

2XG Gisborne, Tuesdays at 8 p.m.

2XN Nelson, Thursdays at 8 p.m.

2XP New Plymouth, Thursdays at 8 p.m.

2YA Wellington, Mondays at 7.15 p.m., Thursdays at 12.33 p.m., Fridays at 7 p.m. (Feilding stock market report).

2YZ Napier, Tuesdays at 12.12 p.m. (Hawkes Bay orchardist session), Tuesdays at 7.10 p.m., Wednesdays at 7.15 p.m. (Hawkes Bay-Poverty Bay livestock market report), Thursdays at 12.33 p.m.

2ZA Palmerston North, Mondays at 12.33 p.m., Fridays at 8.45 p.m. (Feilding stock market report).

3XC Timaru, Tuesdays at 8 p.m., Thursdays at 8 p.m.

3YA Christchurch, Mondays at 12.20 p.m., Wednesdays at 7.15 p.m. (Addington stock market report), Thursdays at 12.33 p.m. and 7.15 p.m.

3YZ Greymouth, Thursdays at 12.33 p.m.

4YA Dunedin, Wednesdays at 7.20 p.m., Thursdays at 12.33 p.m.

4YZ Invercargill, Mondays at 12.33 p.m. and 7.15 p.m., Tuesdays at 7.15 p.m. (Lorneville stock market report), Thursdays at 12.33 p.m.

Establishment of a Household Poultry Flock

ANY householder contemplating the establishment of a domestic poultry flock must first consider the space he can afford for the poultry house and run after provision has been made for flower and vegetable gardens and perhaps fruit trees. Adequate consideration of this aspect before the house is built and the birds are procured will save much trouble and regret later. In this article C. J. Goldsmith, Poultry Instructor, Department of Agriculture, Christchurch, advises on essential points to be considered in determining the size of the flock and in subsequent management. Next month he will discuss the type of replacements to be procured.

THE most important factor when the number of fowls to be kept is being determined is the number of eggs required annually, and a decision is complicated by the fact that it is impossible to state what number of eggs will be laid by a given number of fowls. The number of eggs laid by a fowl depends on many different factors, some of which are:—

Precocity: This is a pullet's ability to lay her first egg at an early age. It is an inherited factor.

Intensity: This factor applies to the number of eggs a bird will lay in a period without resting. Some birds will lay well over 20 eggs a month, others as low as 10 or 12. Eggs are laid in clutches which vary from bird to bird. For example, one pullet will lay daily for 5 days and then miss 2 days, and another may lay for 2 days and then miss a day. Each bird has its own particular pattern.

Winter pause: This is the habit of some birds during winter of missing long periods between clutches. Sometimes birds will partially moult.

Persistency: This refers to a bird's ability to continue laying late in the season and before the annual moult. Fowls with little persistency will moult early, often about Christmas. These are poor producers and should be culled.

Feeding and management: Though the above-named factors are inheritable, a great deal depends on feeding, rearing, housing, and all the points of good management that have been discussed in previous articles and will be covered again in subsequent issues of the "Journal".

Average Production Figures

It would appear therefore that the only method of determining the number of eggs that can be produced is to find average figures that are within the reach of birds of reasonable quality plus good management. In this connection figures from the Breeders' Laying Trial conducted by the Department of Agriculture at Upper Hutt for 48 weeks ended 3 February 1952 may be of assistance.

Pullets were housed in pens of 20 birds each and all received identical feeding and management. The hen-housed average production was an increase over that of previous years, which illustrates the variableness of laying from year to year. The hen-housed average is the total number of eggs laid divided by the number of birds placed in the pens at the start of the trial.

HEN-HOUSED AVERAGE EGG PRODUCTION PER PULLET FROM ALL PENS

	1949-50	1950-51	1951-52
Heavy breeds ..	149.6	175.0	178.2
Light breeds ..	152.6	151.3	167.7

The number of eggs from individual pens in 1951-52 ranged from 194.8 to 135.8 per bird for Australorps, and 206.1 to 85.7 per bird for White Leghorns. The average production over the 3 years was 167 eggs approximately for heavy breeds, and 156 eggs approximately for light breeds.

From these figures it would be reasonable to expect production from a small pen to average at least 150 eggs per laying pullet.

If the householder needs 2 dozen eggs a week for 12 months, the following figures decide the number of pullets required:—

24 × 52 =1248

1248 ÷ 150 = 8 pullets

It must be remembered, however, that 8 laying pullets may not necessarily give 2 dozen eggs weekly.

If it is assumed that 8 laying pullets are sufficient to supply the household with eggs, the first requirement is a laying house large enough for that number of birds. As each bird requires 5 sq. ft. of floor space (preferably 6 sq. ft.), a building of 40 to 50 sq. ft. is needed. Therefore, for 8 laying pullets, a house 5ft. by 10ft. is required.

Replacements

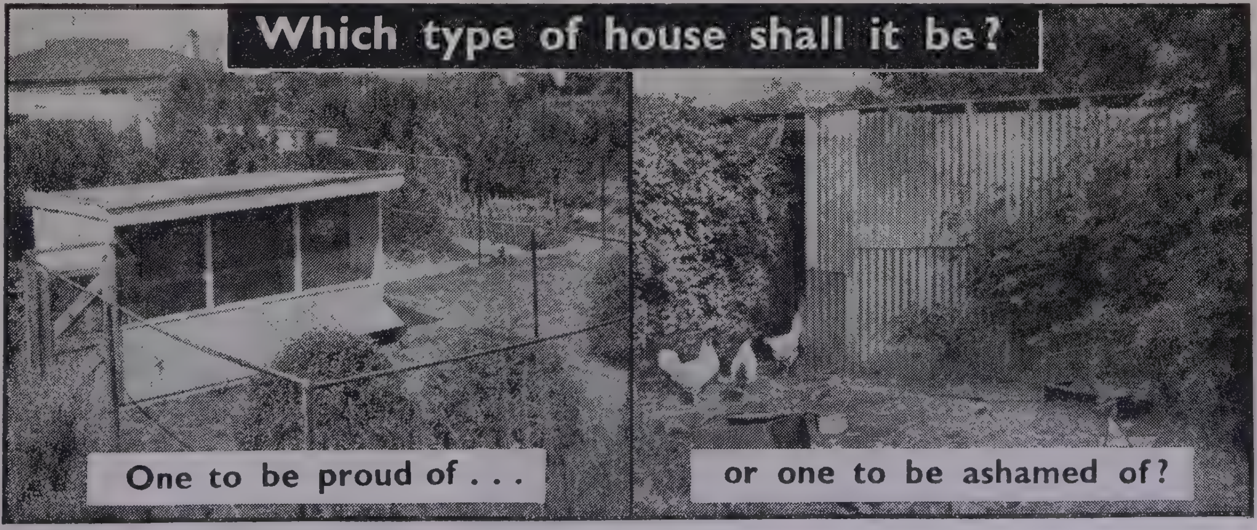
One of the reasons for planning is that unfortunately fowls have a comparatively short productive life. Not very long after the householder has built a house and purchased his pullets he has to consider such questions as:—

1. Whether or not the pullets should be kept next year as laying hens?
2. Should he have part annual replacements each year?
3. What type of replacements (hatching eggs, day-old chickens, perched pullets, or laying pullets) should be procured?
4. Where are the replacements to be housed?

Methods of replacement are largely determined by the poultry keeper's preference, but as this article is intended for beginners, a course of action is suggested.

Keeping Pullets as Laying Hens

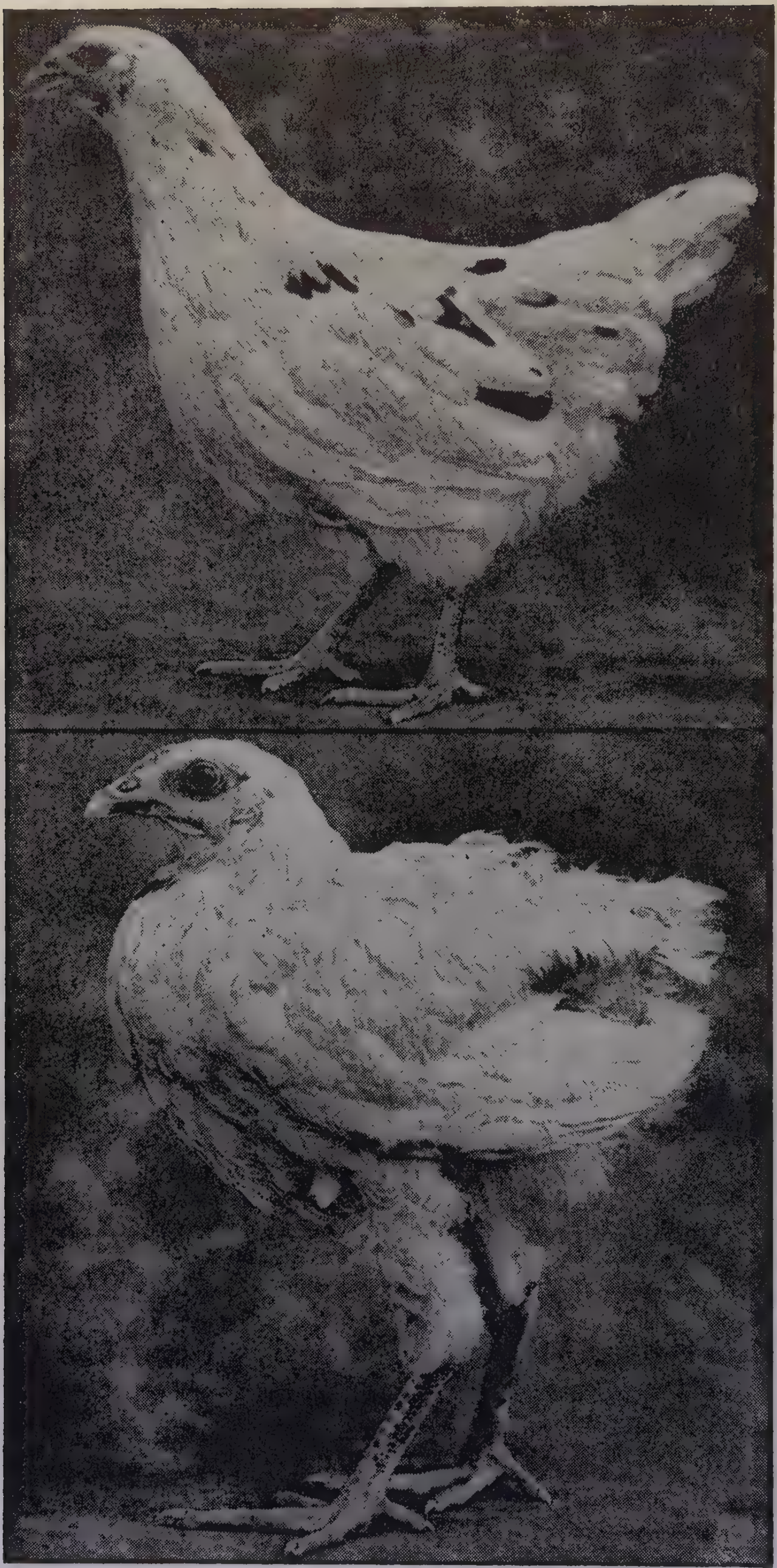
It is unlikely that the original 8 pullets will all be alive or worth keeping for a second year. Reasons for this assumption are the average mortality rate as observed in Breeders' Laying Trials, fatness, and inability to continue laying.



Which type of house shall it be?

One to be proud of . . .

or one to be ashamed of?



[*Fraser Niederer*

Selection of the right type of bird is most important. The type of bird shown in the upper illustration will give eggs and be satisfactory, but that in the lower illustration will eat food, but will never be satisfactory.

In the Breeders' Laying Trials for the years given mortality figures were:—

PERCENTAGE MORTALITY

	1949-50	1950-51	1951-52
Heavy breeds ..	12.5	10.8	19.4
Light breeds ..	18.1	16.2	14.4

The over-all percentage for both breeds was 15.2, which for 8 birds could mean 1 death and probably 1 cull.

From those birds which remain, after deaths during the first year and culling at the end of the laying season, there will be lower egg production in the second laying season. Egg production declines in each succeeding year of a bird's life; often there is as much as 20 per cent. decrease between one year and the next. This may well result in too few eggs for the family. Of equal importance is the fact that birds kept over from the first year are out of production for some 3 months while they are passing through the annual moult, a period which coincides with the period of high prices for eggs.

Even if these birds were kept another year, the question of replacements would eventually arise.

Part Annual Replacements

Because of the reduced laying by the birds, large numbers of household poultry keepers buy a few replacements each year in an endeavour to make up the leeway. Very often these young birds are reared and kept with the hens, sometimes of another breed. After a few years of this practice the flock becomes just a nondescript collection of birds, with backward pullets endeavouring to compete with hens of every type and condition. There are seldom sufficient birds of comparable age and condition to give a continuity of eggs, even if the new pullets are given satisfactory rearing conditions.

The answer to these problems would appear to be the erection of another pen capable of holding enough young birds eventually to replace the laying pullets in the original pen. By the time the replacements have settled down to continuous laying, the older birds can be sold or eaten and the house cleaned out and made ready for another season.

The required birds and housing to this stage are 8 original laying pullets with their pen, and 10 replacements with their pen. This can of course mean one house subdivided to give two sections or pens.

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Propagation by Hardwood Cuttings in Flower Garden

By A. G. KENNELLY, Horticultural Instructor, Department of Agriculture, Dunedin

PROPAGATION by cuttings is probably the simplest and quickest way of increasing a stock of trees and shrubs. It is a method much used commercially for the propagation of certain types of plant, as by it the desirable characteristics of the parent plant can be reproduced in the progeny. Variegated, weeping, fastigiate, dwarf, or other special types which, if produced from seed, may differ greatly from the parent can readily be multiplied. So, too, can stocks of plants that do not produce seed, or if they do, do so only after many years.

TO be consistently successful with cuttings it is necessary to choose the most suitable type of wood (and this differs a little with different plants), to take the cutting at the right time, to prepare it correctly, and to insert it to the right depth into a suitable medium and thereafter give it the temperature, humidity, and light most suited to it.

Nearly all soft and loose wooded plants grow readily from hardwood cuttings, but plants with denser wood are usually propagated from soft or growing wood. Cuttings should be from wood that is healthy, characteristic of the plant required, and free from insect pests or disease. Most hardwood cuttings are chosen from well-ripened wood of the current year's growth, but there are many degrees of maturity in wood and choice of the best type is a matter of experience, though some trees and shrubs, for example, poplars and willows, can readily be propagated from young or old wood.

Though cuttings are commonly classed by home gardeners as stem cuttings, and grouped as hardwood or softwood, they can be made from any part of a plant that has a primary tissue or meristem; that is, undifferentiated plant tissue characterised by rapid cell division. This tissue occurs at the tips of stems and roots, between xylem and phloem of vascular bundles (cambium), in the cortex (cork cambium) in the young leaves, and in many monocotyledons at bases of nodes in the stem. Meristems may also arise due to wounding. Cuttings may therefore be made from stems, leaves, tubers, roots and rootstocks, or rhizomes. Hardwood cuttings as a group are among the most difficult of plant parts to root, though with modern methods most kinds can be rooted.

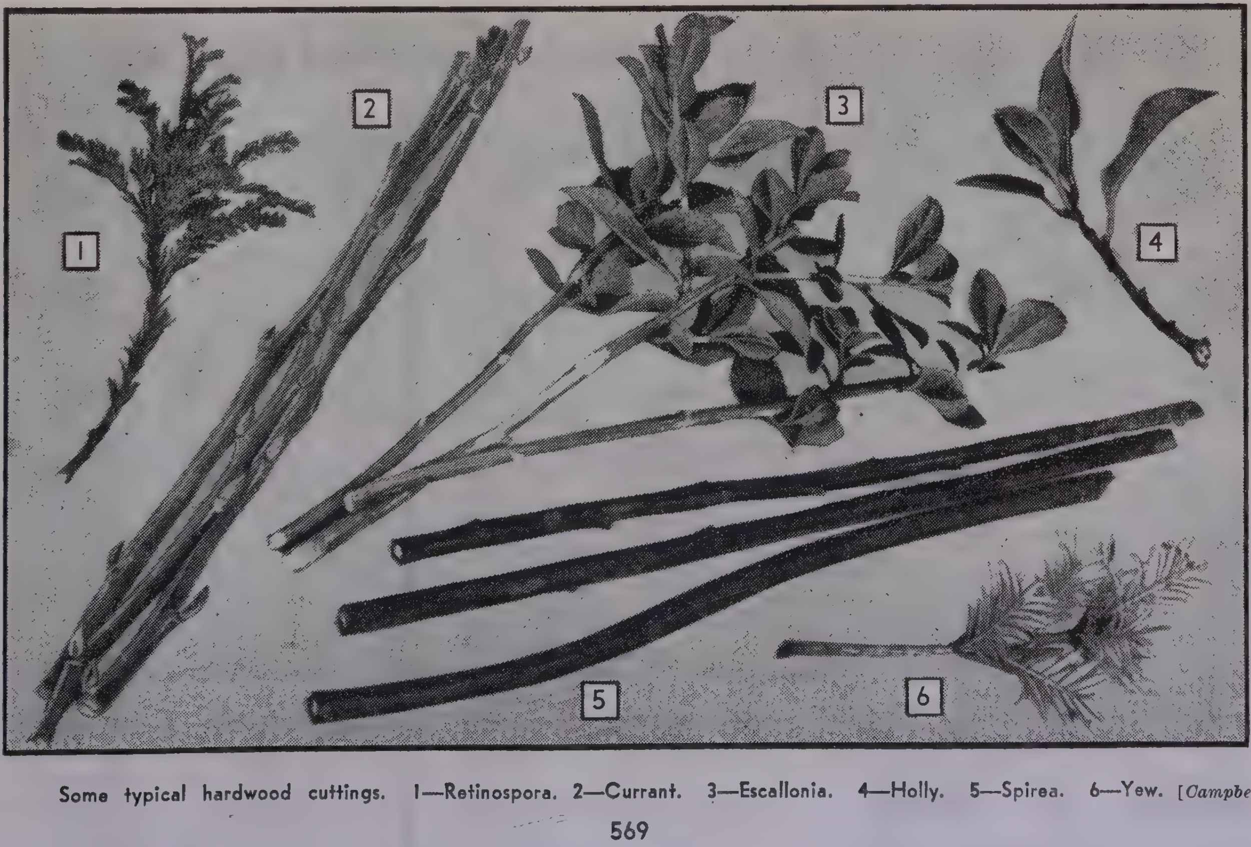
Selection and Time of Taking Hardwood Cuttings

Generally hardwood cuttings of trees and shrubs will root most readily and develop into the best plants if they are made from well-ripened wood of the current year's growth. Exceptions are plants such as tamarix, poplar, willow, and maple, which may be propagated from 2- or 3-year-old wood.

Choosing wood of the right maturity is largely a matter of experience and practice, as in taking cuttings what constitutes maturity varies with different species. Wood for cuttings should not be too old or hard, or too young or soft. Cuttings may be from 4in. to 15in. long, depending on the plant being propagated. When the cutting is being formed it is usual, where a top cut is made, to make it slightly above a node and the lower cut slightly below a node, though different kinds of cuttings give different responses with regard to the points of origin of the roots. If a plant roots fairly readily from a cutting trimmed at a node, it will often give even better results if cuttings are prepared from a heel, as the heel usually contains a number of dormant buds.

Leaves have an important effect on the rooting of evergreens and the top leaves of evergreen hardwood cuttings should not be removed, as with most species the more leaves that are retained on the cutting the quicker, other factors being equal, rooting will take place.

Hardwood shrub or tree cuttings can be taken at any time of year that suitable wood is available, provided they can be given favourable growing conditions, but they are usually taken in late autumn or early winter. In defining



Some typical hardwood cuttings. 1—Retinospora. 2—Currant. 3—Escallonia. 4—Holly. 5—Spirea. 6—Yew. [*Campbell*

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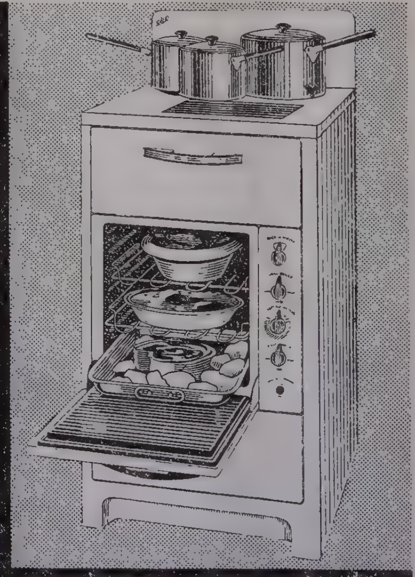

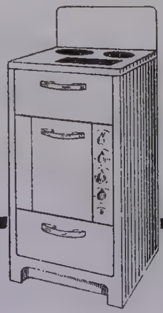

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THE *G.E.C.* COOKER

[Campbell

Prepared cuttings inserted in pots ready for removal to the propagating house or frame. From left—Retinospora, taxus, camellia, azara, viburnum, and ilex. In the foreground are prepared and rooted cuttings of some of the above together with (second and third from the right) *Garrya elliptica*.

cuttings it is sometimes difficult to draw a line between cuttings of half-ripened wood (hardened green cuttings) and cuttings of mature or fully ripened wood (hardwood cuttings). Though no inflexible distinguishing line can be drawn, a half-ripened cutting is of wood still active and producing leaves and a well-ripened one is of wood that has completed its seasonal growth. Plants such as roses, philadelphus, skimmia, aucuba, currants, tamarix, cherry, laurels, rubis, jasminum, pyracantha, and kerria can be propagated from half-ripe cuttings or from fully ripe wood. Most root readily from fully ripened or hardwood cuttings set out in the open ground in March or April, though in favourable situations they can be propagated much later, even until the beginning of September.

Taking the Cuttings

Roots originate from hardwood stem cuttings in two ways. First, they originate as adventitious roots; that is, roots that arise in an abnormal position or that are not essentially inherent. They usually develop in the cambium, but sometimes in the callus. They are fairly general and often develop near the basal cut, but may develop anywhere on the stem, either at a node or internode where it is in contact with the rooting media. Secondly, there is the type of rooting due to what is known as pre-formed root initials, or root primordia, which are small groups of cells or very small roots different from the cells in which they occur. They develop until they reach the outer surface of the bark and then become dormant. Hardwood cuttings from stems containing primordia form roots freely from the primordia, though in certain plants the roots are formed only toward the end of the dormant season.

Most failures with cuttings originate in faulty preparation of the cutting, and practice and experience are necessary for success with all the plants the gardener has to deal with. With most plants cuttings should be taken just below joints or nodes. Clematis is the most notable exception, and with it internodal cuttings have been found more successful. It is advisable, too, that cuttings of most trees and shrubs should contain at least two nodes, though there are a few exceptions.

In forming cuttings the basal cuts should be made with one stroke of a sharp, clean knife. If the wood is too hard to allow this, it should be cut with a bevel and then pared clean across the base of the node. Brittle wood can be notched first so that if great pressure must be exerted to cut through it, and there is danger of it breaking, it will break below the node and will not be spoilt for forming into a cutting. The length of the cutting to be taken depends on the type of plant. A general rule is that where the parent plant has large branches and broad leaves a larger cutting is taken than from a plant with short twiggy shoots and small leaves. Long cuttings are commonest and most common hardy trees and shrubs, for example, poplar, willow, currant, gooseberry, and forsythia, are propagated by them. Short cuttings of ripened wood require more attention and are more used in the propagation of greenhouse plants such as dracenas, cactus, and camellia.

Conifers are sometimes propagated by hardwood cuttings. Usually cuttings of well-ripened wood about 3in. to 5in. long are used. The needles or leaves are trimmed off the lower 2in. to 3in. With the pines, spruces, and firs, the gum or resinous content of the wood is an obstacle to rooting, as it tends to congeal at the base of the cutting and prevent the formation of callus. It is difficult, if not impossible, to scrape away, but can be dealt with by dipping the end of the cutting for a few minutes in water hot enough to melt it. With subjects such as retinospora, taxus, cupressus, and juniperus hot water treatment is not necessary, as though they contain tannins and terpenes, they are not resinous. Most conifers root slowly and may take 6 or 7 months or more to root. The cuttings are made, preferably with a heel, of young wood, though 3- or 4-year-old wood is commonly used because of the difficulty of getting sufficient young wood.

Rooting of Cuttings

Various composts are used for rooting cuttings, the essential factor being good drainage combined with adequate, though not excessive, retention of moisture. Clean, sharp sand is probably more generally used than any other material. It should be free from decaying organic matter which may induce rotting of the cuttings and should not contain lumps of clay which will tend to seal and so reduce the supply of oxygen essential to the life of the cutting. Sand should be large enough in particle size to permit good aeration, but not so large that it dries out readily. Sand by itself is used only where the cuttings are to be lifted as soon as they have rooted. If cuttings are to be left for a time after they have rooted, a mixture of sand

Some Plants that Can be Propagated

The number of plants propagated by hardwood cuttings is very great. Most hedge plants can be so treated. The following list gives some of the commoner plants which can be rooted in the open from hardwood cuttings:—

Azalea
Berberis
Diervilla
Fuchsia
Hydrangea
Ilex
Kerria
Kolkwitzia
Lagerstroemia
Leptospermum
Ligustrum
Lonicera
Philadelphus
Polygonum auberti
Poplar
Rhododendron
Rosa
Salix
Spiraea
Tamarix

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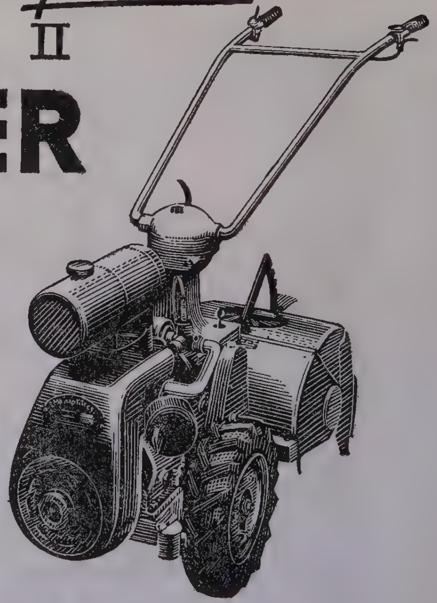

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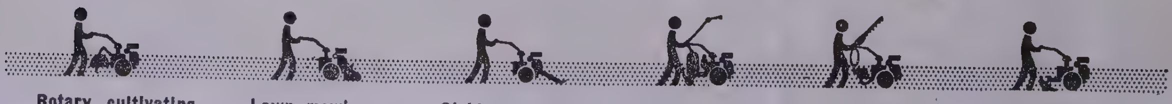

Rotary cultivating | Lawn mowing | Sickle mowing | Spraying | Hedge cutting | Cultivating and fresh, disease-free loam is preferable. Acid peat, coconut fibre, or sphagnum moss are sometimes used either separately or mixed with sharp sand, though their use is mainly confined to properly constructed propagating pits. In the open or in frames clean sand, sand and fresh loam, or well-drained loam are most generally used.

The cuttings must be firm, and in nursery rows it is usual to tamp the soil around the cuttings. Cuttings do not require strong light, though they must be given as much as they can bear. Strong sunlight is accompanied by heat and may cause too rapid transpiration, which may result in wilting unless humidity is high. Etiolation of the stems or rooting areas, however, is regarded as an aid to rooting and some propagators blanch stems by covering them against the light to stimulate rooting. The exclusion of light causes the chlorophyll to disappear and in some cases roots are caused to develop in the darkness.

Temperature and humidity are important in rooting cuttings and temperature control is essential for rooting many difficult subjects. In general cuttings root most readily in a close, moist atmosphere, with mild bottom heat to stimulate the flow of sap. Practically all cuttings of half-ripened wood need these conditions for best results, but bottom heat is also important for most hardwood cuttings, especially for those taken in late winter and early spring, to induce root activity before shoot growth occurs. Root development may take place over a wide range of temperatures, but a soil temperature of 65 to 70 degrees F. gives satisfactory results with a wide range of plants. Soil warming by electric cable is a comparatively recent development that has given excellent results in the heating of hot-beds and greenhouse benches, as by its use a uniform temperature, itself very important, can be maintained at a low cost.

Provided temperatures are kept high enough and attention is paid to sanitation so that the interiors of propagating pits and frames are kept free from disease, a very high degree of humidity can be maintained by spraying the walls, floors, and beds with water. This prevents the cuttings from drying out.

A recent development in the rooting of cuttings is the use of dilute chemical solutions to induce rooting. Permanganate of potash, vinegar, and cane sugar have been used with some success on various subjects, but are now superseded by synthetic plant hormones made up in different compounds. The compounds that have been used successfully include a number of crystalline acids, the commonest being indoleacetic, naphthalenacetic and indolebutyric, some of which are marketed in New Zealand under trade names. The basal ends of cuttings are either coated with a powder containing the active chemical or stood in a dilute solution of it. The cuttings of some plants respond only to specific kinds of hormones; others do not respond to hormone treatment. For the most satisfactory results with hormones it is best to consult one of the authoritative books on the subject. Some list hundreds of plants and give the specific chemical and most suitable dilution for each plant.

Garden Work for July*

Aeration of lawns is important in that it not only improves the physical condition of the soil, but also, by reason of this, promotes root growth and thus encourages a good turf. Aeration can be obtained by pushing a garden fork in every few inches as far as it will go and drawing it straight out again without any levering.

Bulbs grown in pots or pans for decoration in the house should be watered sparingly until the flower buds appear to ensure that the leaves will not be longer than the flower stalks at the time of blooming. After the buds have appeared above the soil, water may be applied more liberally, but care should be taken to see that the soil never becomes waterlogged.

Drainage of the soil is well worth consideration at this time of year. It is a good plan especially where the garden is a new one, to dig a few holes here and there and leave them open during the wettest season of the year so that if there should be any waterlogging below ground level, it can be seen and remedial steps

[*Campbell*

Cuttings in rows in a propagating bed. From left—*Retinospora leptoclada, Cryptomeria elegans, Retinospora plumosa aurea,* ceanothus, *Rhododendron fragrantissima,* euonomous.

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* This section has been prepared by C. K. Ellis, formerly Horticulturist, Department of Agriculture, Dunedin.

planned. Very few plants can tolerate waterlogged soil, even for a short period.

Frosts and the accompanying thaws are advantageous on heavy clay soils in that they break a cloddy condition down to a fine tilth. For this reason it is good to leave such soils dug in late autumn or winter without further cultivation until they are required in spring. However, such breaking or loosening is a disadvantage where shrubs have been newly planted, as it tends to loosen the soil about the roots. The soil should be trodden down again round newly established shrubs after each series of frosts.

Gladioli may now be planted in milder northern districts. It is still too early to plant flowering-sized corms in most other parts of the Dominion, but cormlets may now be planted so that they get the longest possible growing season. They should be sown 1in. to 2in. apart and about 1½in. deep.

Greenhouse plants such as gloxinias, streptocarpus, cyclamen, and tuberous begonias can be propagated from seed sown in July. The boxes or trays should be filled to within an inch of the top with a finely sieved compost and thoroughly watered with a fine rose. The seed is sown thinly over the surface and covered with a very light and finely sieved layer of soil. A sheet of glass should be placed over the box and the whole covered with brown paper to conserve moisture and exclude bright light. The boxes should be inspected frequently and as soon as the seedlings have appeared the paper should be removed; otherwise the small plants will become drawn.

Iceland poppies should be regularly inspected from now on for symptoms of the virus disease spotted wilt. Once infected, plants never recover and are best removed from the soil with a trowel and burnt to reduce the spread of the disease to a minimum. The hands should be washed thoroughly after tending infected plants before proceeding to handle healthy ones.

The following is a description of the symptoms of the disease extracted from "Textbook of Plant Virus Diseases" by K. Smith:—

> The first symptom is a clearing of the veins of the youngest leaves. These leaves become somewhat twisted, cease growth with the appearance of symptoms, and gradually turn yellow. The whole centre of the plant acquires a pallid, stunted appearance In affected field plants, where the rosette of leaves is usually more vigorously developed than in pot plants, a bunched habit is acquired because of the stunting and yellowing of many central leaves. Frequently purplish blotches appear on some of the yellowed leaves or on their midribs or petioles, and a necrosis (dying of the tissue) may set in and destroy the petiole while leaving the leaf blade unaffected. Although diseased plants usually remain alive for weeks in a stunted condition, a rapid extension of the necrosis seen on the petioles sometimes causes the sudden death of the plant. The flowering stems of affected poppies are frequently much twisted and bent over; when they do grow erect they are shorter than normal, more sappy, and brittle, and the buds frequently open badly. The opening of the buds may be delayed until after erection from the recurved position, so that the tip of the bud points vertically upwards, a condition not seen in healthy poppies. The sepals, instead of lifting normally from the receptacle, often confine the petals so long that they burst out laterally. On the flowering stems of many affected plants water-soaked areas may appear from which a drop of milky-white latex exudes. This soon becomes brown on contact with the air and dries to a small, hard pellet. The exuding of a brownish drop of liquid from necrotic patches on the leaf petioles or midribs in their early stages also occurs at times.

Savoury Pies

THE ingredients required for the savoury pies illustrated are ½lb. of short pastry, 1lb. of minced beef, 1 teacup of tomato pulp, 2 teaspoons of meat extract, and salt, pepper, and nutmeg.

Roll pastry to ⅛in. thickness, cut in 3in. rounds. Mix remaining ingredients. Put a spoonful of meat mixture in the centre of half the pastry rounds, moisten the edges, and cover each with another circle. Press the edges well together, brush each pie over with milk, make a small hole in the centre of each, and bake them at 400 degrees F. for 25 to 30 minutes.

Japanese iris (*Iris laevigata*) is fibrous rooted and may be divided and replanted during July. It needs a soil which is moist all year round, though not waterlogged or boggy, and rich in organic matter.

Shrubs which flower on the current season's wood can now be pruned by cutting back to within a few inches of the older stems all the shoots which flowered during the previous season. This treatment, administered annually, ensures a constant supply of new flowering shoots and prevents any tendency for the shrubs to become straggly. A few of the shrubs which should be pruned thus are ceanothus Gloire de Versailles, *Spiraea japonica* var. Anthony Waterer, *Clematis jackmanni*, and *Buddleia variabilis*.

Roses should be pruned now in all but the coldest districts where frosts may kill any induced new growth or the ends of pruned branches, thus ruining the shape of the bush. For flower garden display all young shoots should be cut back to within 9 to 12in. of their bases and all old, dead, or weak shoots and side shoots should be removed. Where exhibition blooms are required much harder pruning is the rule, but this results in fewer blooms and a less shapely bush and is not recommended for the home gardener.

Seed of a number of plants suitable for bedding displays should be sown this month under glass. Among these are antirrhinums, *Verbena venosa*, calendulas, lobelias, East Lothian stock, nemesia, *Torenia fourneri*, and *Phlox drummondi*. The method of sowing is the same as that outlined for greenhouse plants except that the compost need not be so fine and a heavier covering should be made over the seed after sowing.

Sweet pea seedlings raised from seed sown last month or earlier and germinated in the frame or greenhouse should now be gradually hardened off by giving them more air and less protection. They may be planted out in the milder districts 15in. apart for exhibition blooms and 4 to 6in. apart for mass display.

Other Work for the Month

Annuals sown in the borders in autumn should now be thinned to 8 to 9in. apart.

Planting out **bedding plants** can be continued in the milder districts.

Perpetual flowering carnations under glass should have cuttings taken from them now.

Ferns should have dead fronds removed and a layer of compost spread over the roots.

Hardy herbaceous perennials such as helenium, rudbeckia, kniphofia (red-hot poker), and gaillardia should be planted now.

Pot plants should not be over-watered at this time of year. They do not take up much water during winter and easily become waterlogged.

Trees and shrubs which arrive from the nurseryman when the soil is wet and cold should be heeled in until better conditions for planting prevail.

Finishes of Textiles other than Wool

CLOTH as it comes from the loom is generally unattractive, uninteresting, and entirely lacking in consumer appeal. To make it desirable to buyers it must be subjected to various finishing processes, depending on the use for which it is intended. These finishes affect the appearance and feel of the cloth and are designed to that end. But there are other finishes, purely utilitarian, which to be successful must not affect the appearance and feel of the cloth. The following article, by Maud B. Strain, Field Officer in Rural Sociology, Department of Agriculture, Dunedin, is concerned with a few of these special-purpose finishes in non-woollen materials, woollen fabrics having been discussed in another article.

THESE particular finishes, such as crease resistance, water repellancy, and permanent stiffening, add much to the desirability of cloth used for various purposes by decreasing the amount of laundering, pressing, and general care necessary when the finished article is in use.

Crease Resistance

Crease resistance is the ability of a fabric to recover from the folding marks that occur during wear. Crease-resistant fabrics are in constant demand because in wear they do not need so much attention to keep them in good order. Nothing can quite equal the natural spring and resilience of wool and silk fibres, but a high degree of crease resistance can be developed by various means such as variation in the yarns used, perhaps the use of one yarn for the warp and another for the weft. Soft yarns simple in construction combined with complex yarns, and heavy yarns or cords with finer yarns, have all been used effectively in the making of cloth with crease-resistant qualities. Crepe and seersucker effects lower the tendency to crease. As well as these methods, which utilise the natural qualities of the yarns, there are in use various chemical methods which depend on impregnation of the fabric with synthetic resins or gums. These finishes are being used in an ever-increasing variety of fabrics from very sheer to heavyweight. They decrease the crushability to a considerable extent, though they cannot equal silk and wool. With rayons, in particular, these finishes give extra strength to the fabric when wet, decrease the tendency to stretch or shrink, reduce slippage and damage by light, and should ensure longer wear; the extra weight due to the resin also gives better drapability.

Slippage Fault

Thin fabrics woven from very smooth threads are liable to show in wear a fault known as slippage. Fabrics are constructed from yarn running the length of the material, the warp, and yarn running across the width of the material, the weft. In fabrics in which the warp yarns, when seen through a magnifying glass, appear loosely held together, sometimes when there is any tension, on seams especially, the warp yarns slip along the weft yarns, giving a frayed appearance. This is known as slippage. It is not confined to seams, but may happen wherever tension is applied.

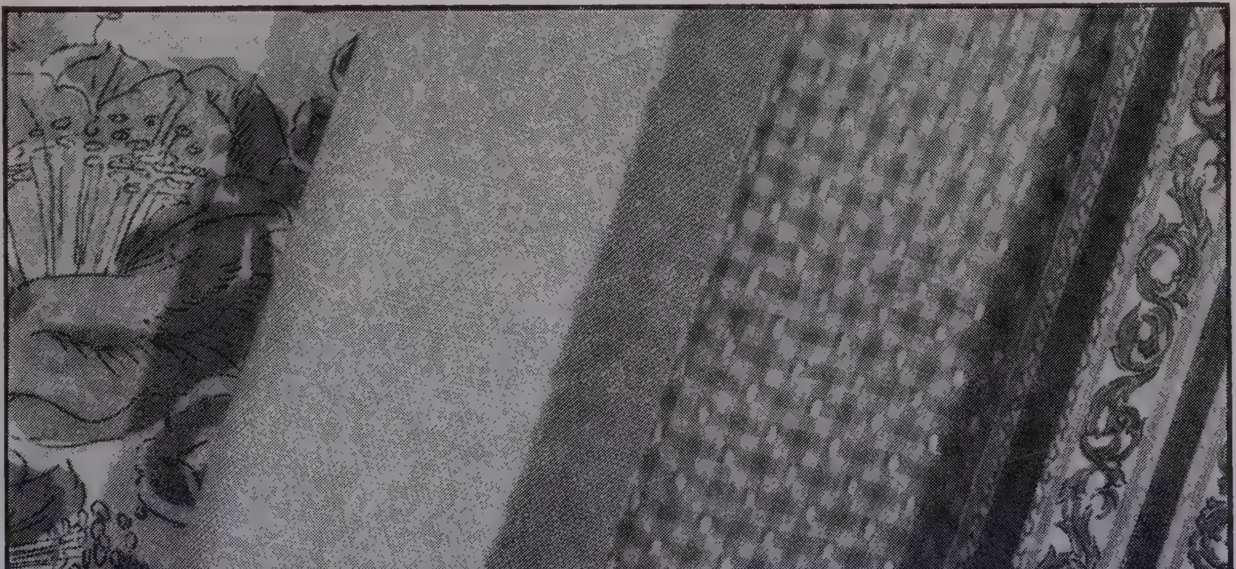
Sometimes a fabric is specially made for a certain finish, and conversely sometimes a finish has to be modified to suit a particular fabric. In the application of this kind of finish it is essential that the fabric be perfectly clean and the amount of resin carefully controlled; otherwise the finish will be uneven and the fabric too stiff or too limp. All excess chemicals must be removed or the fabric may develop an odour or may cause skin irritation.

The crease-resistant finish should not be apparent in the look and feel of the material; it should be obvious only by its performance. It is claimed that fabrics so treated shed wrinkles, resist soiling, launder easily, dry quickly, iron easily, and require no starching.

The advantages of crease-resistant finishes for materials for light frocks and summer sportswear are too obvious to need emphasising. Curtains, bedspreads, loose covers, and other furnishings in these materials retain their crispness and freshness much longer. Washing is easier; no stiffening is required and the appearance of the materials afterward is equal to new. One point must be remembered. The nature of these materials does not allow them to be easily tucked and pleated and they present some dressmaking problems. An electrically heated steam iron is most useful for permanently fixing tucks and pleats in this type of material.

Care

Some finishes last longer than others, but in the main, when properly applied, crease resistant finishes are quite durable. The greatest change occurs after the first laundering. From then onward the crispness and crease-resistant qualities remain much the same through numerous washes. As the dirt remains on the surface of the



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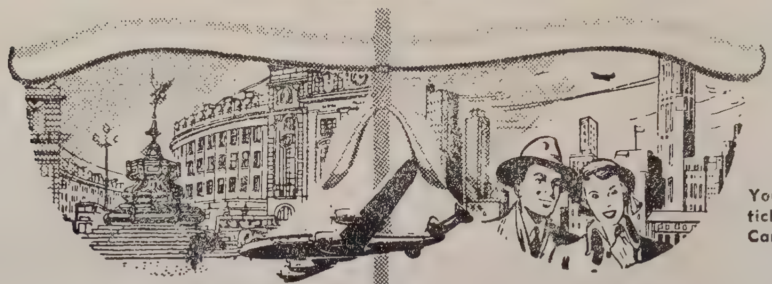

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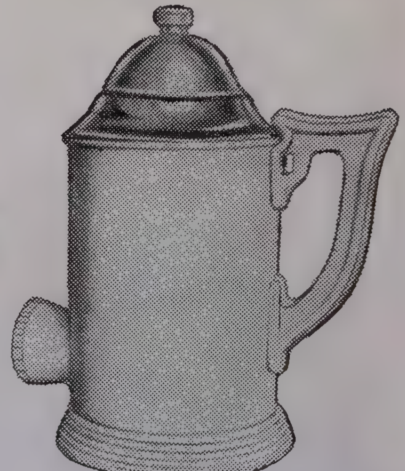

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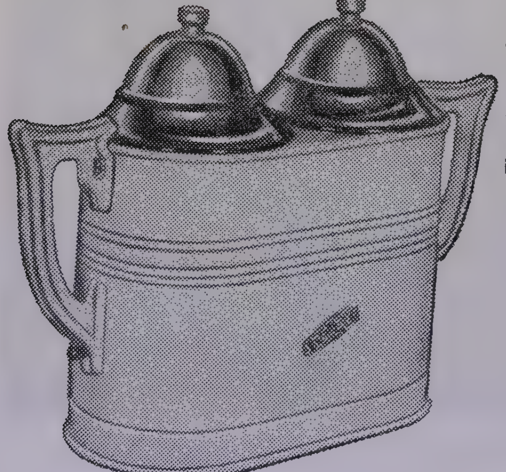

Warming up baby's bottle can become quite a problem! If you are using an ordinary electric jug or saucepan in summertime baby may get colic because the bottle is exposed to flies and contamination. Bottle can also be cracked by too rapid heating. Recognising a need Speedee have introduced **The "Bambino" Bottle Warmer.** Totally enclosed design protects the teat while the milk is heating—eliminates the risk of cracked bottles, and is ideal for sterilizing bottle and teat. Available in attractive colours of Pink, Blue or Ivory and guaranteed for 12 months (complete with 3-core flex and plug top).

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fibres and is readily removed in washing, it is not necessary to use very hot water or very vigorous washing action. The fabrics, being easier to press, do not require so hot an iron. These factors combine to prolong the life of the fabric and the effectiveness of the finish.

Water-repellent Finishes

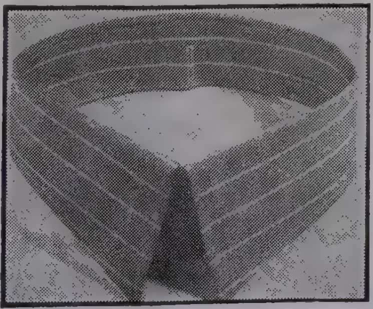
One way of obtaining longer and better service from wearing apparel and fabrics used in household furnishings is to have them treated with a water-repellent finish so that they are not wetted by rain or snow and do not absorb perspiration. They are resistant to non-oily spots and stains, and because of their damp-resisting qualities do not wrinkle readily; also, dirt does not penetrate the surface and the fabric is easier to launder. This treatment can be used for raincoats, for ski-suits, and even for ordinary suits and felt hats. In the house the treatment is useful for window curtains and upholstered furniture. It should be emphasised that this treatment gives water repellancy, not waterproofing. In the waterproofing treatment results were obtained by a film of rubber or oil deposited on the fabric. This made the garments uncomfortable to wear for any length of time, because not only were they impermeable to water from outside but also to water vapour from inside, from the skin. Perspiration could not escape and clothing became damp and clammy.

Present water-repellent finishes are obtained by impregnating the fabric with wax and synthetic resin. They will successfully withstand showers or moderate rain without the fabric absorbing water to an appreciable extent, and the fabric remains porous. Another factor influencing water repellancy is the weave of the fabric; a tighter weave with more twist to the thread will offer considerable resistance to the absorption of water.

Waterproofing

A method of achieving complete waterproofing yet retaining the permeability to water vapour was perfected by the Cotton Research Institute in Manchester during the Second World War. The institute found that specially selected long-staple yarns woven into lightweight fine cloth would absorb water and swell sufficiently to seal the surface. As an extra precaution the fabric was treated with a water-repellent compound. The value of this type of clothing to airmen and others who, through the hazards of war, had to spend long periods in icy water can readily be imagined. This type of material is now available in New Zealand and is used for winter sports clothing.

A slicker which has been waterproofed by having a film of oil applied to the fabric (left) and a shower-proof cotton gaberdine overcoat.



This collar has had a treatment which gives it permanent stiffening.

Two Types of Finishes

Characteristics of the two types of water-repellent finishes are as follows:—

Durable finishes are not readily removed by washing or dry cleaning and are applied in the manufacture of the material. They can be expected to withstand two or three dry cleanings without loss of efficiency. Tweed overcoat material is proofed in manufacture after the scouring is completed and during finishing processes.

Re-treatable finishes must be renewed after each cleaning or laundering. This type has the advantage of being applicable to the made-up garment, which may not originally have been water repellent.

Any material may be treated for water repellancy as expediency demands. The desirability of such a material for outer wear is obvious; less evident perhaps are its uses for furnishings. Here its resistance to soiling and to the penetration of non-oily liquids enables it to maintain its original freshness much longer.

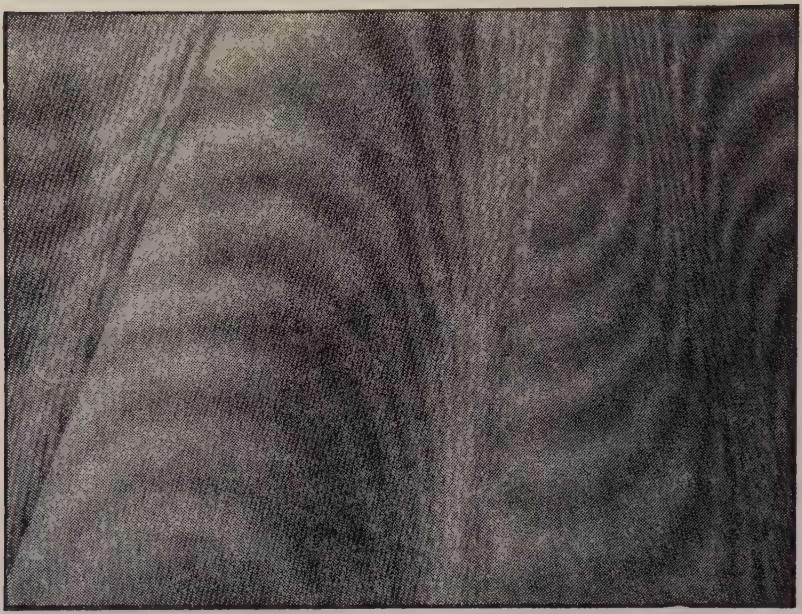
Care

Water-repellent fabrics need reasonable attention. Dirt reduces the resistance to wetting, as does soap, and if a garment or fabric is washed, all traces of soap must be rinsed out. Bleaching powder should never be used; the finish may be the type that combines with the chlorine in the bleaching powder to cause discoloration and weakening of the fabric.

Stiffening

Cotton and linen can be given stiffness, smoothness, weight, and strength by immersion in a starch preparation. This is known as sizing. Some sizing is acceptable, but much is definitely undesirable, because it may conceal inferior construction of the cloth, making a poor-quality material appear better than it really is. Excessive sizing can be detected by rubbing the fabric between the hands. The sizing comes out in the form of a fine powder, exposing the looser texture of the material. This sizing is removed by laundering. At one time in the home stiffening was always achieved by starching and had to be done at every washing. In fact it was not even permanent between washings, because any dampness in the atmosphere caused limpness in the garment.

Newer methods give a permanent finish to laundering without the use of starch. Present-day semi-stiff collars are an example of starchless stiffening. Some depend on a special weave only; others depend on blends of fibres and chemical processes. As an example a combination of cotton and acetate rayon treated with acetone and heat gives a collar that is stiff again after each laundering without any special treatment other than bein



Taffeta with moire finish.

ironed while damp. A permanent sizing process using a combination of synthetic resins makes fabrics resistant to abrasion during wear and washing and also increases their tensile strength. The appearance and wearing qualities of lightweight, weak fabrics are improved by this process and the finish is durable, unlike the original sizing, which was destroyed in the first laundering. Plastic starch has much the same effect. Cotton goods are dipped in the prepared starch. When the material is ironed a continuous film of resin forms over the whole surface and remains for two or three launderings.

Fire-proofing

Textile materials cannot be made absolutely fire-proof, but they can be chemically treated to retard inflammability. Fabrics so treated are flame-proof; that means they will not flare or burn actively. Some fire-retardant compounds affect the softness and flexibility of the material. Almost all of these are destroyed by washing and dry cleaning, but can be re-treated.

Some fibres are more inflammable than others. Silk and wool, for example, burn slowly when a flame is applied, but do not continue burning when the flame is removed. They melt and char, and after a short time the molten mass becomes detached, carrying the flame with it and burning for only a few seconds. Nylon does not burn, but melts, and the hot melt may drop on the skin and cause burns. The highly inflammable fibres are of cellulose origin. Cotton, rayon, jute, hemp, and kapoc all ignite after very short contact with a flame. Sheer filmy cotton and rayon fabrics of open weave such as organdie, muslin, and net are a very real danger. So great is the danger with such materials as lacquered nets that they are now prohibited, after several fatal accidents with them in recent years. Some theatre furnishings and many military fabrics have been successfully proofed.

Whitening

Previously whitening was done by bleaching and maintained through blueing. Newer methods make use of a white dye which is fluorescent. Dyes of this type give off blue or violet light rays which are complementary to the yellowish tinge of white fabrics and thereby give them a pure white colour. These preparations are present in some soap preparations on the market and are very suitable for domestic use. The full effect on the garment of washing with this type of soap shows up clearly when the garment is seen in the light from an ultra-violet lamp.

Effect of Dry Cleaning

Most of these finishes are permanent and are not affected by dry cleaning, with the exception of some of the waterproof finishes. Cotton gaberdine raincoats, for example, are re-proofed as a matter of routine after dry cleaning. Suits, overcoats, and even hats not originally shower-proofed can be made so in this re-proofing process.

Moireing

Although moireing does not belong with the strictly utilitarian finishes, it is mentioned because of its return to favour after a long absence from the fashion world. The familiar lustrous, wavy design is achieved by flattening the fibres of the usually ribbed cloth by passing the cloth between engraved rollers capable of exerting pressure of up to 100,000lb. to the square inch. This finish is not always permanent. If the flattened fibres are wet, they tend to swell and resume their original round form. In cellulose acetate fabrics the design is permanent, because the heat of the moireing process tends to melt, rather than flatten, the design on the material and the design sets firmly on cooling.

Cleaning of Moire

It is necessary to know which type of material is in the garment to be cleaned, cellulose acetate or viscose rayon. Cellulose acetate, being permanent, will launder and dry clean successfully. Viscose rayon cannot be laundered and dry cleaning should be left to those experienced in handling such fabrics. It is inadvisable to experiment with home methods. It often happens that unsuitable reagents are tried which merely have the effect of fixing the stain, making it harder or even impossible to remove later.

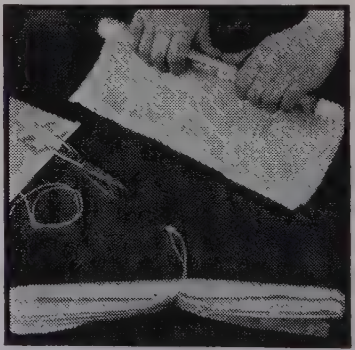
Test to Distinguish Types

A simple test to distinguish between cellulose acetate and viscose rayon may be carried out by burning threads frayed from a small sample of the material or a few threads frayed from a seam. Lengthwise and crosswise threads are in turn held in the flame of a candle. Acetate rayon blazes as it burns, curls, and melts into an irregular black residue that hardens as it cools, forming a black, uncrushable bead. Viscose rayon burns readily, leaving a light, feathery, greyish ash.

Obviously there has been a tremendous advance in recent years in the field of textiles. Research continues and the consumer reaps the benefit in many directions, not the least of which are greater length of time before laundering is necessary, greater ease of laundering, and increased durability.

A Quickly Made Temporary Coat-hanger

If a coat-hanger is needed and there are no spare coat-hangers in the wardrobe or suitcase (if travelling), fold a daily newspaper to a foot or more in length, or use a magazine rolled tightly. Tie a piece of string round the middle of the roll and make a loop for it to hang by.



[*Sparrow*

—*MOLLY MACPHERSON,*
Field Officer in Rural Sociology, Department of Agriculture, Auckland

Knitted Woollies for a Small Girl

A SET of knitted woollies—vest, pilch, and bootees—which would form a much-used addition to a small girl's wardrobe and should encourage its owner to learn to dress herself can be made by following the instructions given in this article.

ABBREVIATIONS used are: K., knit; p., purl; st., stitch(es); st.st., stocking stitch; tog., together; inc., increase; dec., decrease; d.c., double crochet; tr., treble; ch., chain.

Vest

Materials required for the vest are 1¼oz. of unshrinkable 3-ply wool, 1 pair of No. 9 knitting needles, a medium-sized crochet hook, and 1yd. of narrow ribbon.

Measurements are: Length, 10½in.; width all round under the arm, 12in., stretching to 18in.

Tension should be 12 st. and 8 rows to 1in., with the ribbing unstretched.

Front

Cast on 72 st. First row: P. 1, * k. 2, p. 2; repeat from * to last 3 st., k. 2, p. 1. Second row: K. 1, * p. 2, k. 2; repeat from * to last 3 st., p. 2, k. 1. Repeat these 2 rows until work measures 9in. from beginning, ending with a second row.

Neck shaping: Next row: Rib 31, cast off 10, rib to end. Continue on last set of st. as follows: Next row: Work to neck. Cast off 3 st. at beginning of next row and next 2 alternate rows, after which dec. 1 st. at same edge on next 3 rows. Work 2in. on these st., ending at neck edge, then cast on 34 st. Leave these st. on a spare needle and work other side to match first as far as the cast-on st., then with the same needle work across the cast-on st. and other side. Continue on these st. for 10½in. Cast off loosely.

Sleeves

Mark the shoulder line with a pin, then pick up and k. 30 st. each side of shoulder line. Work 3 rows in rib, then dec. 1 st. at both ends of next row and every following fourth row until 50 st. remain. Work 1 row, then cast off loosely.

Making up

Sew up side and sleeve seams.

Work an edging round the neck as follows: Join wool to one shoulder, work 5 ch., miss 2 st. of edge, 1 tr. in next st., * 2 ch., miss 2 st. of edge, 1 tr. in next st.; repeat from * all round, ending with 2 ch., then slip st. to third of the 5 ch. at beginning of round. Next round: * d.c. in first space, 4 ch., then 1 single crochet into the first of the 4 ch., 1 d.c. in same space, 1 d.c. in next space; repeat from * all round, join with a slip st., and fasten off.

Thread ribbon through the holes at the neck.

Pilch

Materials needed for the pilch are 1¼oz. of 3-ply baby wool, 1 pair of No. 10 knitting needles, and ½yd. of narrow elastic.

Measurements are: Length down centre front, 10½in.; width all round widest part, 25in.

Tension should be 8 st. and 10 rows to 1in.

Front and Back

Cast on 80 st. and work 6 rows in k. 1, p. 1 rib, then make a row of holes as follows: Seventh row: * Rib 2, wool forward, k. 2 tog.; repeat from * to end. Work 7 more rows in rib, then change to st.st. and continue in this, but inc. 1 st. at both ends of the fifth row and every following fourth row until there are 100 st. Work 7 rows without shaping, then dec. 1 st. at both ends of every row until 60 st. remain, after which dec. 1 st. at both ends of every k. row until 40 st. remain. Work 1½in. without shaping, ending with a p. row, then begin the back.

Inc. 1 st. at both ends of next row and every alternate row until there are 60 st., then inc. 1 st. at both ends of every row until there are 100 st. Work 7 rows without shaping, then dec. 1 st. at both ends of the next row and every following fourth row until 80 st. remain. Work 5 rows without shaping, then shape the back as follows: First row: Work to last 10 st., turn. Second row: As first. Third row: Work to last 20 st., turn. Fourth row: As third. Fifth row: Work across all st. Sixth row: As fifth. Work 7 rows in k. 1, p. 1 rib, then make a row of holes as before. Work 6 more rows in rib. Cast off ribwise.

Leg Bands

With the right side of the work facing, pick up and k. 104 st. round one leg edge, then work ¾in. in k. 1, p. 1 rib. Cast off ribwise.

Making up

Press the work on the wrong side with a warm iron and damp cloth. Join the side seams and thread elastic through holes at the waist.

Bootees

Materials needed for the bootees are 1oz. of 3-ply knitting wool, 1 pair each of No. 10 and No. 12 knitting needles, a pair of soles about 7in. long, and a medium-sized crochet hook.

The tension should be 7 st. and 9 rows to 1in., and the bootees will fit a child whose footwear size is between 7 and 10.

With No. 12 needles cast on 46 st. and work 6 rows in k. 1, p. 1 rib, then make a row of holes as follows: Seventh row: * Rib 2, wool forward, k. 2 tog.; repeat from * to last 2 st., rib 2. Work a further 15 rows in rib, then make another row of holes as before, after which work 7 more rows in rib. Slip the first 6 and last 7 st. on to spare needles, then with No. 10 needles work in pattern on the 33 centre st. as follows: First row: P. 3, * k. 5, p. 6; repeat from * finishing p. 3 instead of p. 6. Second row: K. 3, * p. 5, k. 6; repeat from * finishing k. 3 instead of k. 6. Repeat these 2 rows once more. Fifth row: P. 3, * k. 2, then make a bobble thus: K. into the back and the front of the next st. three times, making 6 loops, slip the first 5 loops over the last loop, keeping the bobble to the front of the work, k. 2, p. 6; repeat from * finishing p. 3 instead of p. 6. Sixth row: As second. These 6 rows form one pattern. Repeat them 7 times more, then still working in pattern, dec. 1 st. at both ends of next and every alternate row until 17 st. remain. Cast off.

Join the ribbed back seam. Slip the 13 heel st. on to a No. 10 needle and work in st.st., but inc. 1 st. at both ends of every k. row until there are 25 st. Work 1 more row. Cast off.

Making up

Sew the side edges of the heel to the side edges of the instep as far as they will go without stretching. Sew the slipper top to the sole, fold the top ribbing over, and thread a cord or a crocheted ch. through the double row of holes.

Accompaniments and Garnishes

THE art of good cooking lies in the clever combination of flavours, colours, and textures which will please the palate and appeal to the eye. That cooking is an art is undisputed, and though simplicity is the keynote of good design in food as well as in other forms of art, subtle and attractive contrasts will provide interest and variety. A dull meal can be transformed by the addition of a delicious sauce or a colourful garnish, and skill and imagination in the preparation of food will mean that the family eats what it should because the food looks and tastes good. Eleanor Couston, Field Officer in Rural Sociology, Department of Agriculture, Timaru, in this article describes recipes for and methods of making meals more attractive.

STRONG seasonings which destroy natural food flavours should be avoided, but those which enhance such flavours should be skilfully introduced. The well-trained French chef tastes as he works, adding a soupcon of this and soupcon of that until his palate assures him that the flavouring is perfect. A cook who is interested in preparing fine-flavoured food will have a kitchen garden which supplies parsley, chives, mint, and cress, and in her kitchen cupboard a range of herbs, spices, and seasonings for discriminate use.

Colour contrasts in food service are important, but care must be taken to see that colour combinations harmonise. An all-white or an all-brown meal looks dull and unappetising and clashing colours may be equally unattractive.

Texture contrasts are important, too, and here again the accompaniment or garnish may be the means of producing such contrasts.

Delicious food aromas stimulate the gastric juices, and colourful, well-flavoured food has a similar effect. One's mouth may "water" at the sight of a food picture in a book, and a knowledge of how to create attractive dishes can be invaluable in tempting children or those with capricious appetites to eat without persuasion.

National food habits vary considerably, but certain "food affinities" have become recognised, and well-known examples such as bacon and egg, roast beef and horse-radish sauce, or pork and apple sauce are legion. In New Zealand, where poultry is expensive and generally reserved for special occasions, there is often some doubt concerning the choice of accompaniments and the suggestions and recipes given here should be of value.

Stuffings

Bread, Thyme, and Parsley Stuffing (for a 4lb. fowl)

2 cups of stale breadcrumbs
1 teaspoon of dried thyme
1 tablespoon of chopped parsley
1 tablespoon of minced onion (optional)
¾ teaspoon of salt
⅛ teaspoon of pepper
2 to 3oz. of butter

Melt the butter and add the other ingredients. Stuff the fowl in the body and neck. Sew up and skewer.

Rice Stuffing (an alternative for chicken)

1 cup of boiled rice
1 chopped onion
½ cup of chopped ham
1 tablespoon of butter
2 teaspoons of chopped parsley
Salt and pepper

Melt the butter in a saucepan. Add the onion and saute until golden brown. Add rice mixed with ham and seasonings and fry for 3 minutes.

Veal Forcemeat Stuffing

½lb. of lean veal
1 teaspoon of parsley and herbs
Nutmeg and mace to taste
Salt and pepper to taste
1 teaspoon of grated lemon rind
2oz. of fat bacon

Chop or mince the meat and bacon and mix all the ingredients.

Sausage Stuffing (for a medium-sized turkey)

2lb. of lean pork or bacon or sausage-meat
1 teaspoon of salt
½ cup of breadcrumbs
½ teaspoon of mixed herbs
½ teaspoon of pepper
Giblets, chopped

Mince the meat and add the breadcrumbs, seasoning, and giblets. Mix these well and moisten with a little stock.

Sage and Onion Stuffing (for duck, goose, or pork)

1 cup of chopped onions
1 tablespoon of chopped parsley
1 tablespoon of finely chopped sage leaves
2 cups of breadcrumbs
¾ teaspoon of salt
⅛ teaspoon of pepper
1½oz. of butter

Mix all the ingredients and add the melted butter (the onion may be parboiled if desired).

Prune Stuffing (for roast duck)

2 cups of breadcrumbs
2oz. of melted butter
1 teaspoon of salt
¼ teaspoon of pepper
1 cup of sliced apple
1 tablespoon of minced onion
1 cup of cooked prunes
1 lemon rind, grated

Place the breadcrumbs in a mixing bowl. Stir in the melted butter with a fork, add the remaining ingredients, and mix well.

Apple and Raisin Stuffing
(for goose or turkey)

½ cup of diced bacon
1 cup of chopped celery
1 cup of chopped onion
7 cups of breadcrumbs
¼ cup of sugar
6 medium tart apples (diced)
1 cup of seedless raisins
½ cup of chopped parsley
2 teaspoons of salt
¼ teaspoon of pepper

Saute the bacon until crisp and remove from the pan. Cook the celery, onion, and parsley in the fat for 3 minutes and remove. Put the apple in the fat, sprinkle with the sugar, cover, and cook slowly till glazed. Add all the ingredients and combine well.

Sauces

The sauce is the symbol of civilised eating, and fine sauces are intended to accentuate delicious flavours in food rather than to disguise them. The reason so many people are heard to say "no sauce, thank you", is that they have been served with the uninteresting and unappetising type so often that they prefer their food without it. Many delicious sauces may be served with desserts, and a good cookery book will supply inspiration. For meat, fish, and savoury dishes there are also endless possibilities, but a good variety can be made from the one basic recipe given here.

Foundation White Sauce

1oz. of butter
½oz. of flour
1 cup of milk
½ teaspoon of salt
⅛ teaspoon of pepper (optional)

Melt the butter in a saucepan or the top of a double boiler. Add the flour and salt and stir until blended, but not brown. Remove from the heat and add ⅓ of the milk. Blend well, return to the heat, and stir until thickened. Add another ⅓ of milk, mix quickly. Add the remaining milk and stir well. Heat quickly to boiling point, stirring continually. Cook for a further 2 minutes. If a large quantity is being made, some of the milk may be heated to save stirring time.

Sauce Variations

With the foundation sauce used as a base, the following varieties can be made:—

Parsley: Add 2 to 4 tablespoons of finely chopped parsley. Serve with boiled mutton, fish, or vegetables.

Egg: Add 1 diced, hard-cooked egg. Serve with boiled or steamed fish.

Cheese: Add ½ cup of grated cheese. Stir over low heat until the cheese melts. A half teaspoon of mustard may be added if desired. Serve with fish, eggs, or vegetables.

Anchovy: Add 1 to 2 teaspoons of anchovy sauce or paste. Serve with fish.

Caper: Add 2 to 4 tablespoons of capers. Serve with boiled mutton.

Oyster: Make the foundation sauce, using half milk and half oyster liquor. Add 1 teaspoon of lemon juice, ½ teaspoon of sugar, and a dash of nutmeg. Just before serving add 6 chopped oysters. Serve with omelettes or fish custard.

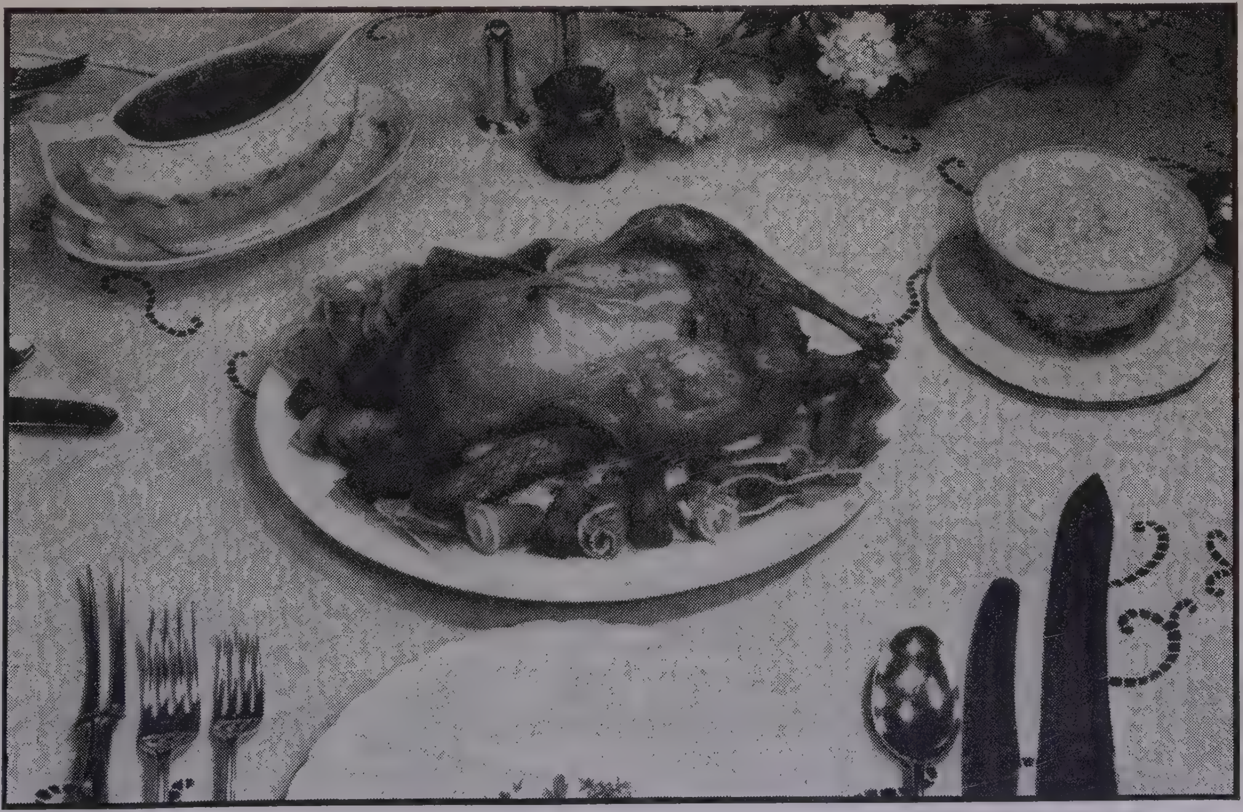
Tomato: In the foundation sauce recipe substitute 1 cup of thin tomato puree for the cup of milk. Add ½ teaspoon of grated onion. Serve with fish, meat loaves, croquettes, or omelettes.

Veloute: In the foundation sauce recipe substitute 1 cup of veal or chicken stock for the cup of milk. Serve with grilled or baked fish or croquettes.

Bechamel: Use chicken stock or milk and cook in it 1 slice of onion, 1 slice of carrot, ½ bay leaf, stalk of celery, sprig of parsley, and 4 peppercorns. Strain and make as for the foundation sauce. A half cup of thin cream may be added. Serve with chicken.

Mock hollandaise: In the foundation recipe substitute water for the milk and add 2 tablespoons of butter. Stir until blended. Just before serving add 2 teaspoons of lemon juice and 1 egg yolk, slightly beaten. Serve with fish or lamb chops.

Mustard: Add 2 teaspoons of prepared mustard. Serve with corned beef.



Roast chicken with bacon rolls, small sausages, potato crisps, thin gravy, and bread sauce.

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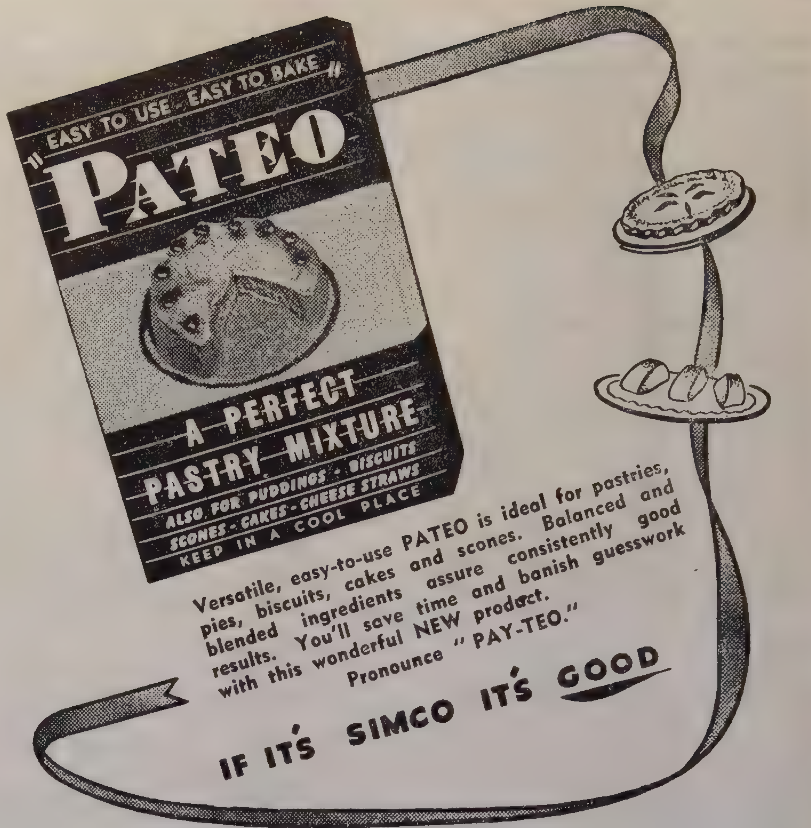

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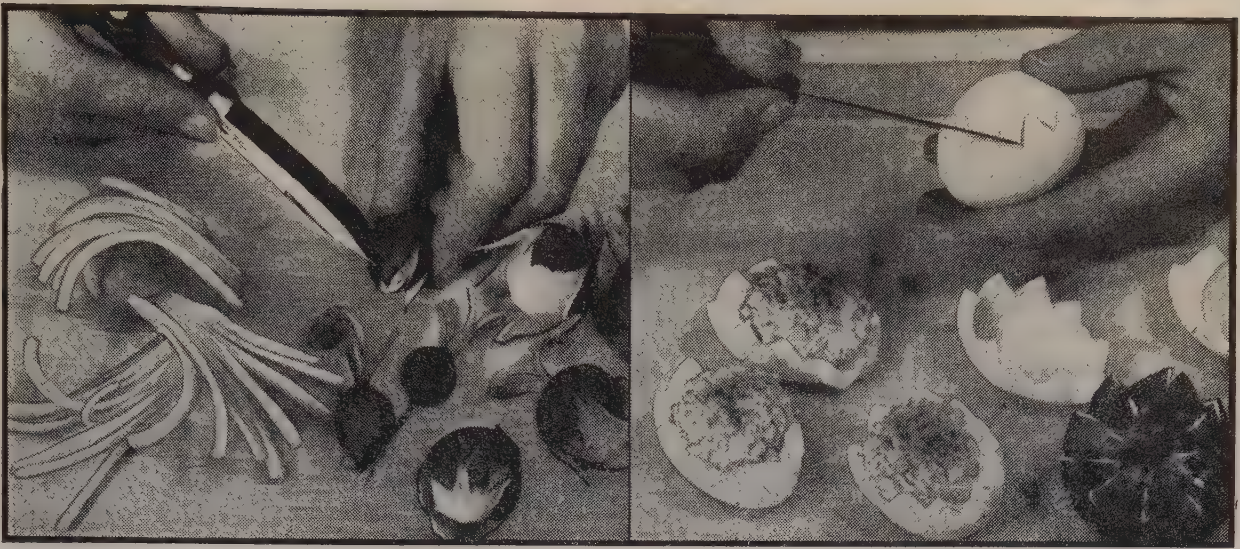


Making of attractive garnishes. Left—Celery curls and radish roses. Right—Serrated edging on hard-boiled egg and on tomato.

Garnishes

Garnishes are primarily for decorative effect, but should be chosen to improve the flavour as well as the appearance of food. The garnish is an accessory only and should be comparatively small so that the main dish is not obscured. It can, however, provide sharp contrast in both colour and texture, but should always be in harmony with the main theme. Green is one of the most successful contrasts for savoury dishes, but other colours may often be used to good effect. Over-handled food looks unattractive and the garnish should be prepared in advance and added as the final touch. The right garnish daintily arranged will add interest to any meal and well repay the extra time spent in preparation.

For Savoury Dishes

Parsley is the most commonly used and should be well washed and drained and broken into sprigs, or finely chopped, just before being served. It can also be combined with butter to make parsley butter for serving with grills.

Parsley Butter

1 heaped teaspoon of chopped parsley
1 teaspoon of lemon juice
1oz. of butter
Salt
Cayenne (a few grains)

Warm and cream the butter. Work in the parsley, lemon juice, and seasoning. Leave to harden, then shape into pats.

Watercress is grown in water and should be gathered only from a safe source. Its colour and flavour provide an excellent accompaniment for fish, poultry, or grilled food and it can be used also in salads or sandwiches. Before use it should be washed in salted water, rinsed, and drained.

Mustard and cress may be grown very easily in a small box and used in the same way as watercress.

Mint provides an aromatic flavour for many dishes, and a sprig added to green peas and new potatoes enhances their flavour. It is used for mint sauce as an accompaniment to lamb and mutton and chopped in salads, or as a garnish to grapefruit or cold beverages.

Chives are a very small variety of onion. Their leaves give a mild onion flavour and pleasing colour to salads, mashed potatoes, savoury dishes, and sandwiches.

Celery, though used both raw and cooked as a vegetable, can make an attractive garnish when curled. To make celery curls cut stalks into 3½in. lengths, then slice these lengthwise, cutting to within ½in. of the end. Place in ice water or cold water to curl.

Cucumber may be served as a garnish for fish dishes, cold entrees, or salads. A cucumber can be given a decorative look by deckle edging, which is done by drawing the tines of a fork down the length of the cucumber before slicing it. Cones can be made by cutting a cucumber into thin slices, making one cut from the edge to the centre of the slices, and shaping.

Radishes: When used as a garnish bright, round radishes can be made into roses. With a small sharp knife cut well into the radish from the tip toward the stem end, making 6 to 8 cuts. Cut back the "petals" and place the radish in ice water to curl.

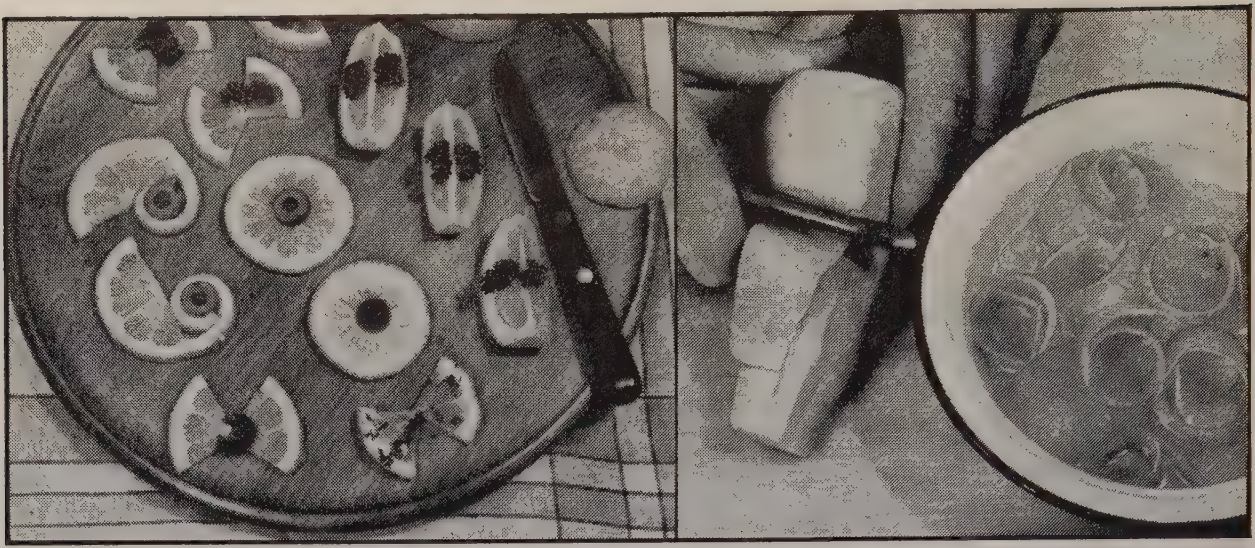
Beetroot has an attractive colour, but should not be used with tomato or carrot, as these colours do not harmonise. It can be cooked and served in slices or grated raw.

Root vegetables: Carrots, parsnips, and turnips may be used either grated or cut into thin, matchlike strips about 1¼in. long. Carrot curls are made by cutting wafer-thin strips lengthwise, rolling these round a finger, and placing them on ice. Carrot "flowers" are also attractive and are formed by making lengthwise cuts ⅛in. deep into a carrot, then cutting the carrot crosswise into paper thin slices. The petals will curl when placed for an hour or so in ice water.

Tomatoes may be sliced, cut into wedges, or shaped as "lilies". To make lilies use a sharp knife and shape the tomato by cutting in sawtooth fashion round it and into the centre. Fan-tans are made by slicing a peeled tomato

ACCOMPANIMENTS FOR POULTRY

Meat	Stuffing	Extra accompaniments	Vegetables
Roast fowl	Bread, thyme, and parsley, or veal forcemeat or rice, ham and onion	Thin gravy, bread sauce, small sausages, bacon rolls, watercress garnish	Saratoga chips, new potatoes, peas, diced carrots, beans
Roast turkey	Bread, thyme, and parsley, or veal forcemeat or sausagemeat or chestnut (if available)	Thin gravy, bread sauce, small sausages or bacon rolls or ham or cranberry sauce (if available)	Roast potatoes, brussels sprouts, celery, artichokes
Roast goose	Sage and onion or apple and raisin	Gravy, apple or gooseberry sauce	Roast or creamed potatoes, brussels sprouts, artichokes
Roast duck	Sage and onion or prune or apple and onion	Gravy, orange salad or apple, gooseberry, or orange sauce	Roast or chip potatoes, braised celery, brussels sprouts, peas
Boiled fowl		Parsley, hard-cooked egg, or oyster sauce, pickled pork or boiled ham	Mashed or steamed potatoes, peas, beans



More appetising garnishes. Left—Lemon garnishes. Right—Carrot curls.

in vertical slices not quite through and inserting slices of cheese or cucumber.

Gherkins and olives also make colourful garnishes and add a distinctive flavour to savoury dishes or salads.

Capers can be added to the sauce which accompanies boiled mutton, or to mayonnaise for serving with fish or vegetable salads.

Potatoes: Chips, saratoga chips, or lattice potatoes may be served with grills or roast poultry. Saratoga chips are made by paring wafer-like slices from mature potatoes, soaking them in water, drying them, and frying them in deep hot fat (395 degrees F.) until crisp. They are then drained on absorbent paper and sprinkled with salt.

Hard-cooked egg can be used in a variety of ways, either cut into slices or with yolk and white separated. The yolk is put through a sieve and the white cut into shapes or chopped. For stuffed eggs the edges of the eggs may be serrated in the same way as tomatoes are for "lilies".

Bread: Small cubes of bread fried and drained make a crisp garnish for cream soup or pea soup or for serving with hot entrees.

Pastry: Fleurons may be made by cutting small fancy shapes from pastry and cooking them in a hot oven till crisp. They may be served with entrees, mince, and similar dishes.

Noodles in fancy shapes are used to garnish soups and savoury dishes.

Lemon is the ideal garnish for fish and may be cut and served in many attractive ways. To make lemon fans cut slices of lemon ⅛in. thick and cut each slice in halves. Cut the rind in halves again, leaving the centre whole. Splay into fan shapes and dip in chopped parsley or add a sprig of parsley at the centre.

Paprika or red pepper is mild in flavour but bright in colour and can be used on creamed dishes or poached or scrambled eggs, or to make a bright edging for lettuce leaves.

Cheese may be grated and served with salads, sprinkled in soup, or made into cheese balls. If dipped in paprika, cheese balls make a bright and tasty garnish. Cheese cut-outs made with fancy cutters are also a good garnish for salads.

Pineapple or orange slices are used to accompany pork or poultry.

For Desserts

A little dressing up will improve the appearance of many cold desserts and also add variety.

Fruits such as raspberries, strawberries, cherries, orange sections, sliced pineapple, apricots or peaches, or bananas dipped in lemon juice to prevent discoloration may all be used. Chinese gooseberries skinned and sliced are particularly attractive for colour and design.

Jelly may be set in a thin layer and cut into fancy shapes or chopped coarsely and used for decoration.

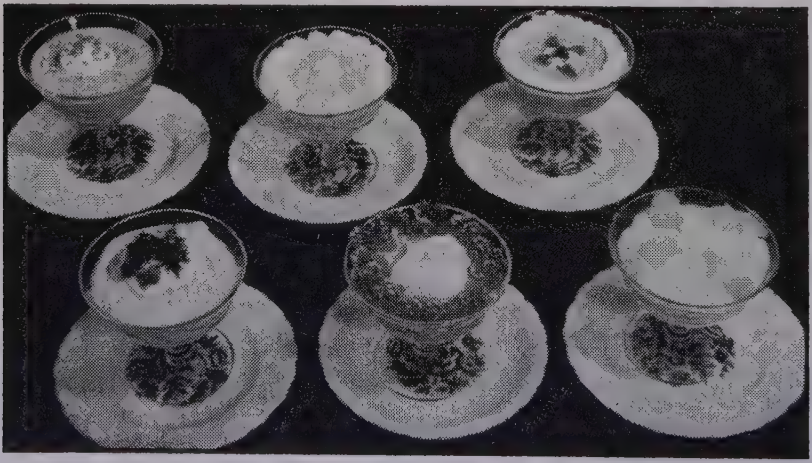
Whipped cream may be used plain or tinted to a delicate shade and piped on to sweets.

Glace fruits such as cherries and angelica after being washed to remove the sugary coating may be shaped into flowers, stems, or leaves.

Chopped nuts are also effective, and shredded coconut, plain, tinted, or browned in the oven, makes an attractive decoration.

Grated orange rind, grated chocolate, marshmallows, or miniature meringues may also be used.

Spun caramellised sugar is crunchy and palatable. To make this heat some sugar in a heavy pan until it is caramellised, then pour it in a thin stream from a height into a bowl of very cold water. Remove quickly from the water and sprinkle over whipped-cream topping. Serve immediately.



Topping for desserts. Upper row, from left—Cream and chopped nuts, cream rosettes, cherry and angelica. Lower row, from left—Spun caramel, chopped jelly, orange sections.

All photographs by Oddies.

Effect of Food Habits on Tooth Formation and Decay

By EVELYN E. MOORE, Field Officer in Rural Sociology, Department of Agriculture, Palmerston North

NEW ZEALANDERS, though perhaps justly proud of their high standard of living, have little to be proud of when dental health is taken into consideration as one of the criteria of good health. This should be cause for serious thought, yet many remain relatively unwilling to regard it as a problem which should be of concern to every New Zealander.

PERHAPS this unconcern is due to the erroneous opinion held widely a generation ago, and undoubtedly still prevalent, that it is easier, cheaper, and even better for the health to substitute artificial teeth for natural teeth at an early age. In addition, such an attitude instilled consciously or unconsciously in the minds of the children of this generation can ultimately do much to impede the progress made by the School Dental Service and others who work to improve the teeth of New Zealanders.

There are many causes of tooth decay, a fact not always appreciated by the average mother, who perhaps corrects or avoids only one of the causes, and then is disappointed or discouraged when her children do not have perfect teeth. In this article will be discussed the various dietary factors which have been shown to affect the teeth. These factors could be divided into two groups: those which help prevent decay, and those which tend to bring it about, or accelerate it, once it has begun.

Structure of Teeth

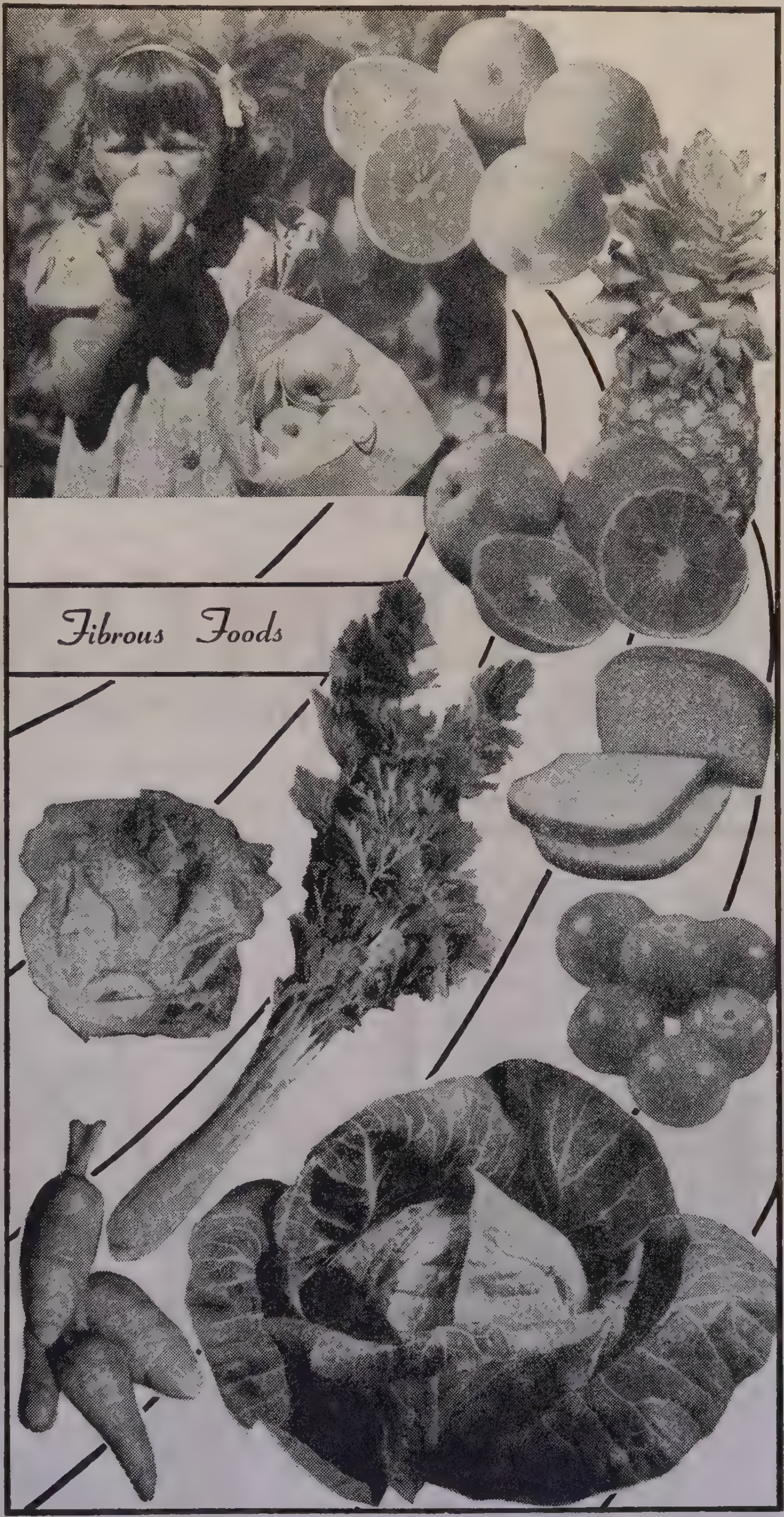
To understand the causes of dental caries or tooth decay it is necessary to know something of the structure, growth, and development of teeth, and also of the direct process of decay, which is what is happening to a tooth as the decayed area or hole grows larger and larger.

The structure of a tooth is shown in the diagrams on page 587. In the diagram of a tooth cut lengthwise through the centre (right) the following different substances are seen:—

(1) Enamel.
(2) Dentine.
(3) Cementum.
(4) Root canals.
(5) Pulp chamber.

Enamel: This covers the surface of the visible part of the tooth and is very hard and dense. It is the most durable substance in the body. It normally protects the tooth from injury and decay. Unfortunately, if this layer is broken or imperfect or eaten away by acid, it cannot be re-formed, and decay is allowed to spread rapidly in the softer layer of dentine underneath. The enamel consists mainly of a complex structure of lime and phosphate.

Dentine: This is the thickest layer and gives the tooth its shape and



[Top left photograph by Sparrow

Good tooth cleansing fibrous foods are apple, orange, grapefruit, pineapple, tomato, carrot, lettuce, cabbage, and celery. Wholemeal bread is strongly recommended in preference to white.

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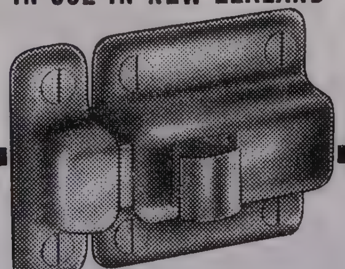

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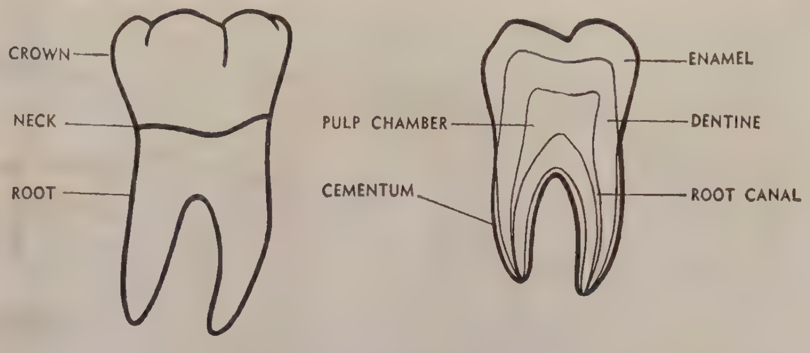
strength. Although it contains the same minerals as the enamel, it is a much less dense and softer structure.

Cementum: This covers the part of the tooth that is below the level of the gum. It is more like bone in structure than the rest of the tooth, and attached to it are the fibres which hold the tooth firmly in place.

Root canals: These are small canals in the roots of the teeth through which run the blood vessels and nerves to the pulp chamber.

Pulp chamber: This is the space in the centre of the tooth—known as "the nerve" to the majority of people—and contains the blood vessels and nerves which nourish the tooth and is also the organ from which the dentine of the tooth was formed.



[From New Zealand Department of Health publication "Sound Teeth"
Left—Typical molar. Right—Structure of a tooth.

Development of Teeth

Teeth begin to be formed about 6½ months before a baby is born, and at birth the process is so far advanced that some of the permanent teeth are beginning to be formed. The crown, the part that will eventually be above the gum, develops first, and it will thus be seen how important it is for the expectant mother to ensure that her diet is adequate in all respects. This care should be exercised also during the time the baby is being nursed.

The eruption of the permanent teeth is preceded by a dissolving process in the roots of the baby teeth and the crown of the permanent tooth pushes its way up until with its newly developed root it finally takes the place of the baby tooth.

It is important that these baby teeth should be kept until the natural time for losing them, if possible, as their early loss means that the child will not chew its food so well, and may develop an overwhelming preference for soft, sloppy foods, resulting frequently in an unbalanced diet and poor health. Infected baby teeth also undermine the health of the child. There is the additional danger that early loss of baby teeth will let neighbouring teeth encroach on the vacant space and leave insufficient room for the permanent teeth to erupt later, possibly causing crowded, irregular, and crooked teeth, which are more apt to decay than sound well-spaced straight teeth.

The first four permanent molars (or back teeth) come through when the child is about 6 years old. These may sometimes be mistaken by parents for baby teeth and be neglected, resulting, perhaps, in irreparable damage to the teeth.

Tooth Decay

Tooth decay is so widespread in New Zealand that practically everyone suffers from it at some stage. Primarily it occurs in children and adolescents. In later life new areas of decay usually develop slowly, and, in fact, almost complete immunity may be developed. Decay usually occurs between the teeth below the point of contact, and in pits and fissures on the chewing surfaces. Soft, sugary or starchy foods which lodge in these areas are not easily removed, and, because the mouth, being warm and moist, is an excellent place for growth of bacteria, they develop rapidly in these films of food. Acid is formed which dissolves the minerals in the enamel, which is slowly eaten away. Next the dentine layer, which is much softer (and more easily eaten away by acid), is reached, and bacteria and food debris accumulate in the cavity formed and more rapid decay occurs. Finally, if the cavity is not filled, the pulp is reached and invaded by bacteria, leading to the formation of an abscess accompanied by acute toothache.

This is, of course, only the immediate cause of decay. The indirect causes mainly have a direct or indirect basis in nutrition, which is the nature and quality of the food eaten, and control of these is in the power of everyone, especially every parent who wishes to start children off in life with good natural teeth.

Effect of Diet

Probably the most important factor in building good teeth, and certainly the one parents have most control over, is diet. This was shown in many countries during the war, when the teeth of children showed a marked improvement due to the greatly reduced availability of sugary foods, the use of bread made of coarse whole grain or high-extraction flour, and the wise and controlled distribution of milk, oranges, and other nutritious foods to those who needed them most, such as growing children.

The body cannot build good teeth without an adequate supply of all the minerals and other nutrients which are required for their development. It is not sufficient only for the mother to provide her growing infant or child with foods containing plenty of these nutrients. Recent research indicates that the diet of the expectant mother plays a very important part in the likelihood of her children having good teeth. In animals, research has indicated that the effect of the mother having a good diet is five times as important as any local effect on the teeth of the young animal. Foods which will ensure that the child or the expectant mother has all the required minerals and vitamins for good bone and tooth growth are milk and milk products, such as cheese, eggs, green and root vegetables, meat, particularly liver, fish, especially fish liver oils, and the fruits richer in minerals and vitamins, such as black currants and other berry fruits, oranges, grapefruit, and tomatoes, and rosehip syrup.

The amounts recommended are:—

Milk: Children and expectant and nursing mothers, 1¾ pints a day; pre-school children, 1⅓ to 1¾ pints a day; other adults, 1 pint a day.

Cheese: A small cube every day.

Eggs: One a day when possible.

Meat and fish: Serve once a day with liver, and fish, when possible, once a week.

Vegetables: One generous serving of each of the following types each day:—

(1) Potatoes or kumaras.
(2) Green vegetable, cauliflower, or swede.
(3) Other vegetables, or an extra serving from the second group.

Raw fruit: One each day.

Fish liver oil: Pre-school children and expectant and nursing mothers, 1 teaspoonful (or capsule equivalent) each day. In winter and spring it is advisable that older children should also have fish liver oil.

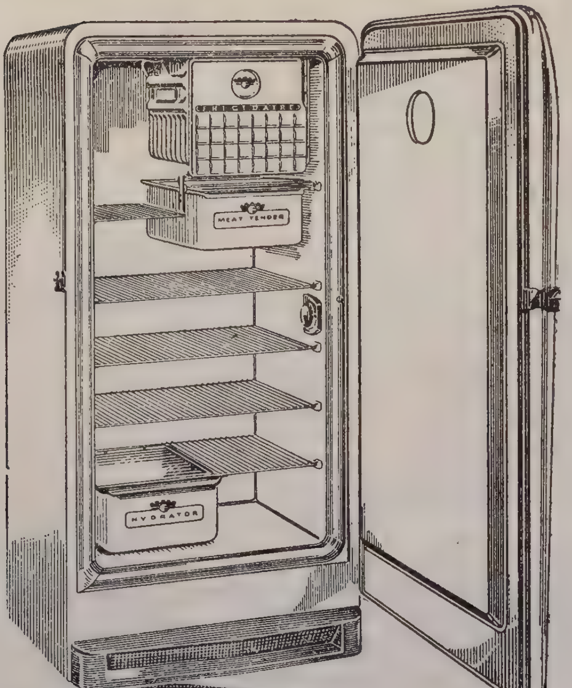
Unrefined cereals, wholemeal bread and butter, and iodised salt should also figure in the daily menu.

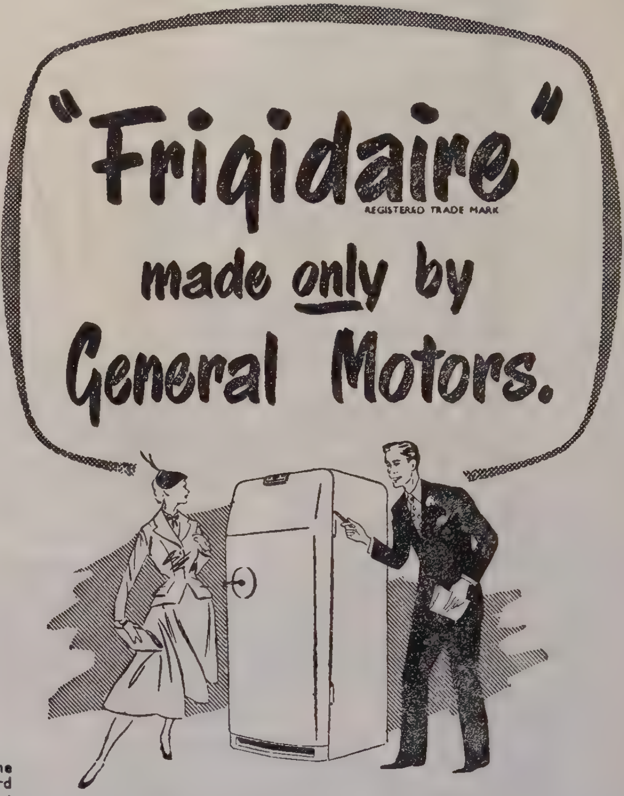
These foods not only provide the nutrients necessary for sound tooth structure, but, in addition, they build up the general health and resistance to infection and infectious diseases, some of which are suspected of causing temporarily a greater susceptibility to tooth decay.

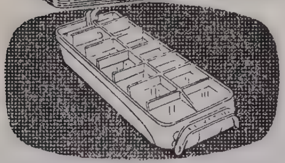
Other Aspects

Primitive peoples usually have good teeth in spite of the fact that their diet may not be as good, in its mineral and vitamin content, as that of their civilised neighbours, who may on an average have a far higher rate of dental decay.

This is because the food of primitive peoples is coarse and unrefined generally, and contains far less sugar or cooked, soft, and doughy foods, and, frequently, more meat or fish or coarse fibrous vegetables, and fruits. The effectiveness of a diet of this nature is due to the cleansing action on the teeth and mouth of the foods eaten. These foods also stimulate the flow of saliva, and because they require more chewing, give the jaws more exercise, a factor which has been shown fairly conclusively to result in better and more rounded development of the jawbones, giving the teeth plenty of room to grow without becoming crowded or crooked. It has been estimated that primitive man gave his jaws 10 times as much exercise as his modern







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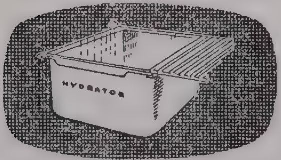

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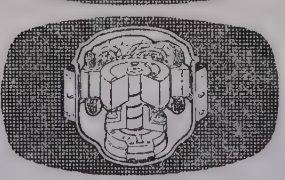

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counterpart, so that it is not surprising that many children today have small pointed dental arches, resulting in crowded teeth, or to avoid this have two or more teeth extracted to make room for the others. These factors can be counteracted in the modern diet in the following way:—

Foods which require plenty of chewing such as crusts, apples, raw root vegetables, celery and salad vegetables, and oven-baked bread should be included in every meal and these foods should be eaten at the end of a meal, as they have a cleansing action on the teeth.

A continual flow of normal saliva has an important influence on the health of the teeth, mouth, and gums, as it normally covers the teeth and as decay begins on the enamel surfaces of the teeth. Foods which stimulate a flow of saliva are hard, dry substances such as oven-baked crusts, crisp raw vegetables and fruits, and also acid fruits such as oranges. Acid fruits particularly stimulate the flow of alkaline saliva, which counteracts the acidity of the fruits and is, therefore, also valuable in neutralising or counteracting the acid formed by bacteria on tooth surfaces.

Some foods such as bread and butter, cakes, or biscuits decrease the flow of saliva below the normal resting flow and cause it to be slightly less alkaline. Thus these foods, which are commonly eaten at the end of a meal, are able to bring about decay in not one way, but in several ways. They cling to the teeth and form a sticky film which is ideal for the development of bacteria capable of causing decay, they reduce the flow of normal cleansing saliva, and they tend to reduce its alkalinity, making it less able to counteract the bacteria-produced acids capable of eating away the tooth enamel.

Two important facts therefore arise. The first is the necessity for a diet containing all the nutrients essential for building sound teeth. The second is the great effect which many foods can have directly on both the causation of tooth decay and the rate at which it progresses.

Thus it is important to see that a child eats few sweets and cakes, but a meal finishing with new bread, butter, and jam will probably be almost as effective in causing decay as one finished with cakes and sweets, unless the bread, butter, and jam are followed by teeth-cleansing foods such as fruit, raw vegetables, or crisp oven-baked crusts. When possible the teeth should also be cleaned immediately after a meal, and the cleaning must be thorough to be effective.

Effect of Fluorine

There is one other factor, which may be considered as a dietary one, and that is the effect of fluorine, a mineral element low in New Zealand soils and water. Overseas and preliminary New Zealand investigations have indicated that this mineral, properly used, will reduce dental decay by about 40 per cent. It has, however, to be supplied during the years when the teeth are being formed, and as far as can be ascertained has no inhibiting effect on tooth decay in adults who have grown up without it. Its use is being tested in New Zealand at present by dentists, the School Dental Service, and others qualified to use it effectively.

[*Department of Internal Affairs*

To be effective tooth cleansing should be done immediately after each meal and before going to bed. About 3 minutes are required to clean the teeth thoroughly.

If the tests are successful, it is probable that within a short time New Zealand children will be able to benefit from its use to reduce tooth decay by one or more of the methods being tried out.

Effect of Diet on Teeth of Adults

Once the teeth are formed it seems probable that the most important factors in reducing decay are careful attention to cleaning the teeth and a general avoidance of the type of menu which ends invariably with sweet soft foods, especially when it is impossible to clean the teeth immediately afterward.

Cleaning the teeth is an important factor in reduced decay, provided it is done properly; otherwise it is more or less useless. To be effective it should be done immediately after each meal and before going to bed. It is estimated that about 3 minutes are required to clean the teeth thoroughly. To hurry over the task is likely to render the cleansing ineffective and a complete waste of time. A toothbrush of the short-headed variety is the best for both children and adults.

Cleaning the teeth immediately on arising probably affords little protection from decay; it is far more effective when carried out immediately after breakfast.

Morning and Afternoon Teas

A factor not always considered is that of eating sweets, cakes, and similar foods between meals. It should be obvious that if it is a regular practice, it is also likely to be a cause of tooth decay.

Ammonium Ion Powders and Pastes

American experiments indicate that ammonium ion powders and pastes have some protective effect against decay in that country, but experiments carried out in New Zealand have so far not shown conclusively that they are of benefit here.

Regular Dental Treatment

The importance of regular visits to the dentist, or in the case of children to the school dental nurse, cannot of course be over-emphasised. Regular treatment not only stops decay, but it can improve the durability of badly formed teeth if children are treated early enough. Protective fillings can be placed in fissures in the enamel of badly formed teeth, crooked teeth can be straightened, and teeth can be removed to prevent overcrowded crooked teeth being formed, as such teeth besides being unsightly are much more subject to decay.

In the case of adults, and it is adult New Zealanders who are most careless with their teeth, dental care not only helps prevent decay, but is also an insurance against the serious onset of gum diseases such as pyorrhoea, which if allowed to continue unchecked, attack the bony sockets of the teeth, causing the teeth to loosen and making their extraction necessary. Causes of these gum diseases include unclean, decayed, and crooked teeth, and inflamed gums, loss of some teeth, badly fitting crowns on teeth, and the regular consumption of soft foods which require little or no chewing.

Artificial Teeth

There are many who argue that it is better to get the teeth out while young because it will be necessary sooner or later anyway, that artificial teeth improve the appearance, and that artificial teeth are better for the health. These arguments are correct only in a few circumstances.

First, there is no reason why a good set of natural teeth, treated with care and well looked after, should not last a lifetime. Many members of primitive races reach old age and still have perfect sets of teeth due to choosing unconsciously a diet which contains none or few of the factors apt to cause decay. The Maori, before the coming of the white people, is a good example. Further, many of the causes of decay and the removal of teeth may be able to be simply controlled as scientific knowledge of this subject increases.

Secondly, the argument that artificial teeth look better than natural teeth may also be easily refuted. It may be so for adults today who have crooked, broken, and badly stained teeth, but there is no reason why children with properly cared for teeth should grow up with crowded, ugly, or crooked teeth.

Causes such as thumb and finger sucking, lip biting, and mouth breathing should be looked for and corrected by parents. Other causes such as too early extraction or too long retention of baby teeth are avoided by regular dental care. Less obvious causes such as illness, lack of foods providing sufficient chewing exercise, and a diet containing inadequate nutrients for good bone and teeth growth can be avoided or lessened by the attention of parents to providing their children with a healthful, well-balanced diet, which would also help build up resistance to disease. It has also been shown that artificial teeth cannot retain satisfactorily the natural contour of the cheeks, mouth, and chin as well as can natural teeth. Lines and sagging of these features occur at an earlier age in the wearer of artificial teeth.

Finally, it is only in cases where retention of natural teeth is obviously not good for the health—where there are abscesses or pyorrhoea, for example—that any advantage to health can be shown.

Though attention to diet—eating the right foods at the right times—may not prevent dental decay, it will certainly reduce its severity. The reduction probably depends on general health, possibly on hereditary factors, and others difficult to evaluate. Allied to regular and careful dental care, however, diet should completely avoid the need for large numbers of young people to resort to artificial teeth.

Parents could do much to improve the dental health of New Zealanders by encouraging their children to clean their teeth regularly and correctly, and to eat foods such as raw fruits and vegetables, eggs, milk, and cheese, and by impressing on them a respect for natural teeth.

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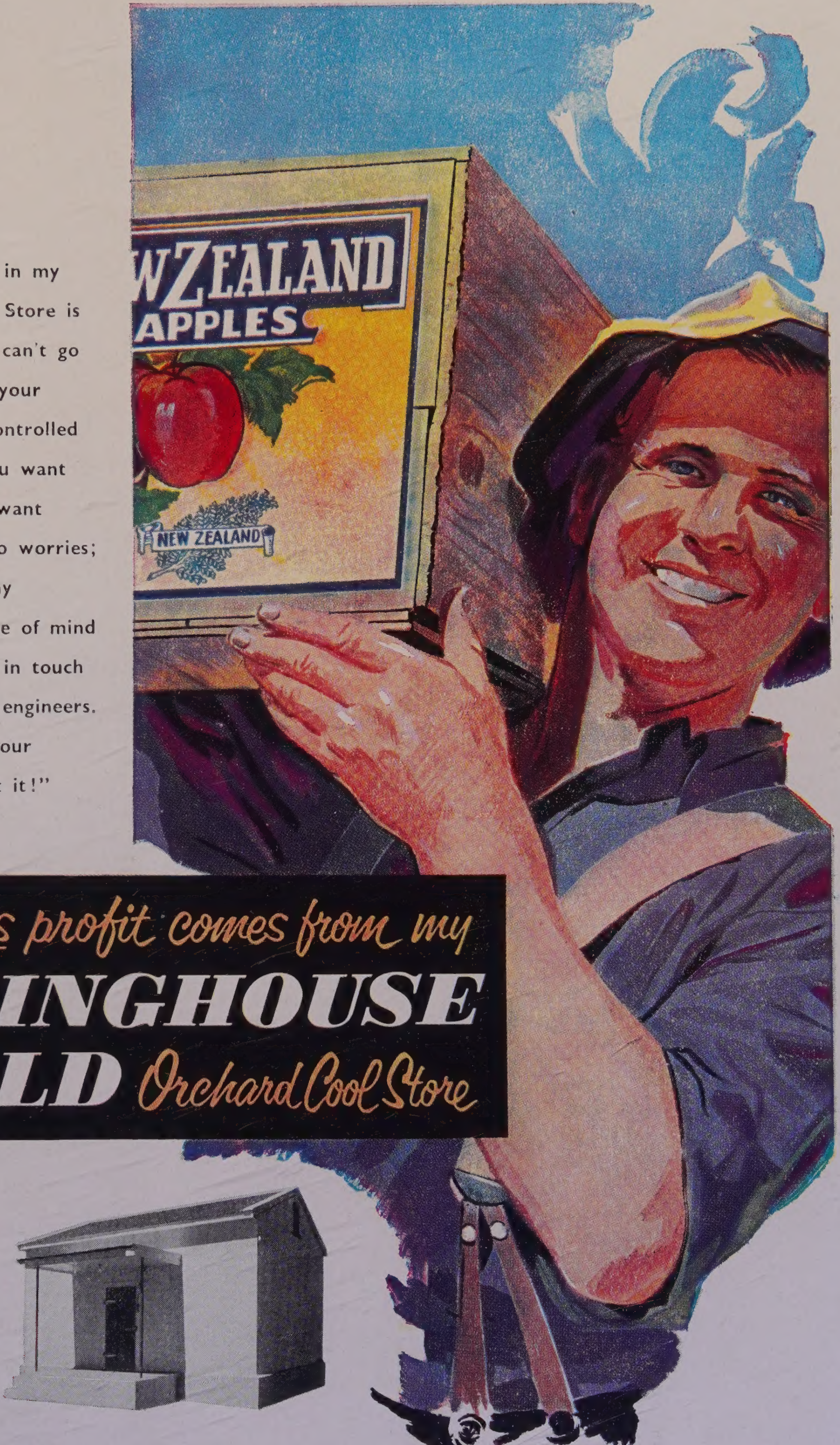

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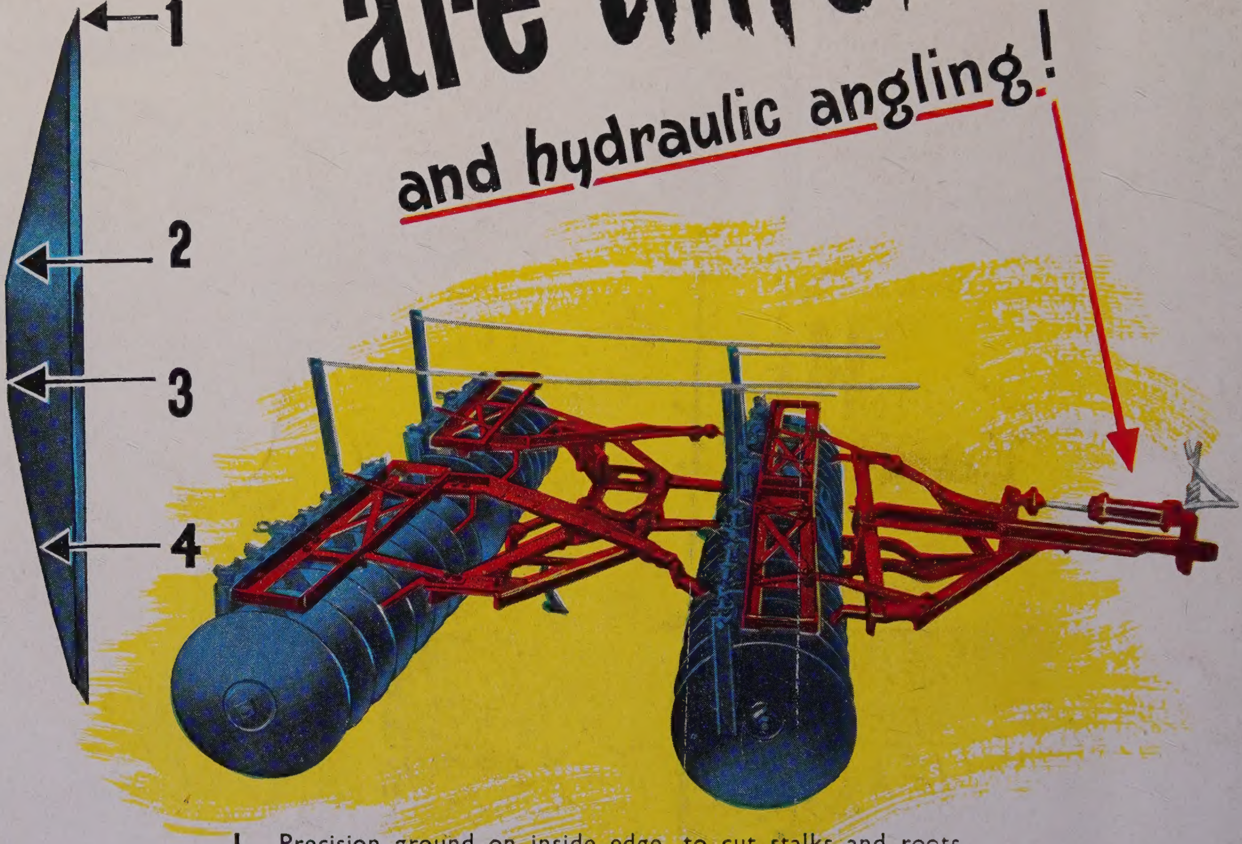

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